Chapter 5

Toxic Air Contaminant Emissions, Air Quality, and Health Risk

Introduction

This chapter presents a summary of the emissions and air quality data available for selected toxic air contaminants, or TACs. The Health and Safety Code defines a TAC as an air pollutant which may cause or contribute to an increase in mortality or in serious illness, or which may pose a present or potential hazard to human health. There are approximately 192 TACs identified in California. Some of these TACs are groups of compounds which contain many individual substances (e.g. copper compounds, polycyclic organgic matter). The summary information includes available data for the ten TACs posing the greatest health risk in California, based primarily on ambient air quality data. These TACs are acetaldehyde, benzene, 1,3-butadiene, carbon tetrachloride, hexavalent chromium, *para*-dichlorobenzene, formaldehyde, methylene chloride, perchloroethylene, and diesel particulate matter (diesel PM). Information is summarized for the State as a whole and for each of the five most populous air basins. It is important to note that the summarized data reflect a spatial average, and the ambient concentrations and health risks for individual locations may be higher or lower.

This section provides general background information on toxic air contaminants, their emissions, and air quality. The following section provides information on a statewide level. The information includes summaries of statewide emissions, statewide annual average concentrations (calculated as a mean of the monthly means), and statewide average health risks, for the ten selected TACs. The final sections of this chapter provide similar information for California's five most populous air basins: the South Coast Air Basin, the San Francisco Bay Area Air Basin, the San Joaquin Valley Air Basin, the San Diego Air Basin, and the Sacramento Valley Air Basin (concentration and health risk data for individual sites within these air basins can be found in Appendix C). It is important to note that the ambient concentration and health risk information presented here reflect data collected only at sites operated by the ARB, and the information presented in this chapter reflects only the ten TACs for which available data indicate the most substantial health risk. There may be other TACs that pose a substantial risk, but for which data are not available (dioxins, for example), or which have not been identified as a concern. Additional information on interpreting air quality data for toxic air contaminants can be found in Chapter 1.

Sources of Toxic Air Contaminant Emissions in California. Similar to the criteria pollutants, toxic air contaminants are emitted from stationary sources, area-wide sources, and mobile sources. The stationary source emissions inventory was developed by the ARB in cooperation with affected industries and the air pollution control and air quality management districts (districts) as part of Assembly Bill 2588, the Air Toxics Hot Spots Information and Assessment Act of 1987 (Hot Spots Program). The ARB developed the emission estimates for area-wide sources and mobile sources.

Emissions of the selected TACs are reported on a statewide basis and for the ten highest-emitting counties in California. Emissions are also included for the five most populous air basins. In general, the inventory base year is 2004. Note, however, that the stationary source emissions inventory uses the best available information for the emission source, although the data may not have been specifically collected for 2004.

Air Quality Monitoring for Toxic Air Contaminants. The ARB maintains a statewide air quality monitoring network for toxic air contaminants. The network was originally designed to measure selected substances in the ambient air to determine if levels were sufficiently high to be of concern. As a result of this monitoring, the ARB has determined atmospheric concentrations for over 60 individual substances. As shown in Figure 5-1, the ARB currently maintains a network of 18 air quality monitoring stations, measuring ambient concentrations of 64 substances. ARB's Monitoring and Laboratory Division began monitoring four new compounds in 2003, three were TACs: acrolein, acetonitrile, and acrylonitrile; one was a non-TAC: acetone. The number of sites is smaller than in previous years and reflects the closure of several sites during 2000. By closing these sites, additional resources were made available to support monitoring for the ARB community health program. The sites selected for closure generally showed concentrations similar to the statewide average, so their closure has a small overall impact on the statewide annual averages. Other factors considered in selecting sites for closure included the total number of sites in the area and the continuity of the data record.

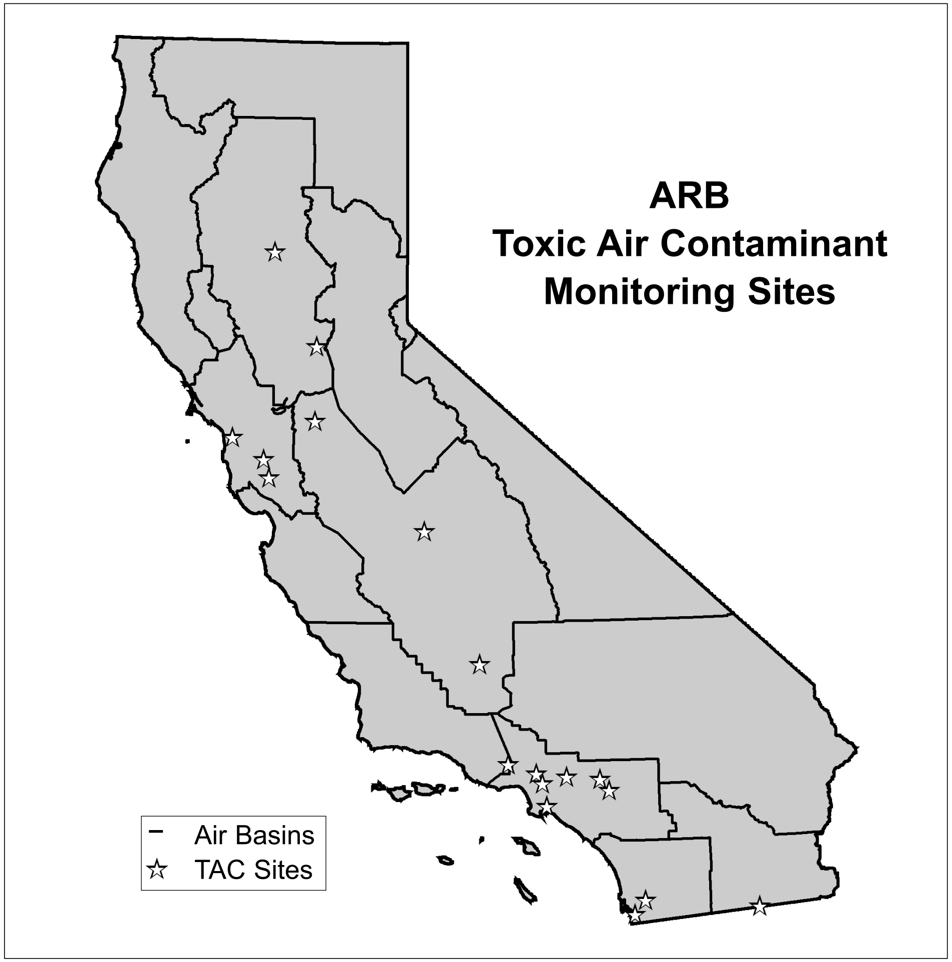

Figure 5-1

TAC samples are generally collected once every 12 days, throughout the year. This results in 20,000 to 35,000 individual TAC measurements annually. The TAC data are typically sampled, analyzed, and reported as 24-hour averages. These 24-hour averages provide the basis for the annual average concentrations. These annual average concentrations are then used to support statewide risk assessment.

The TAC monitoring network is currently designed to provide air quality data in support of general population exposures. Therefore, the data do not provide information on localized impacts, often referred to as near-source or neighborhood exposures. The ARB is currently participating in several studies to address localized impacts and community health issues. For example, during October 1999, the ARB initiated a monitoring and evaluation study in the Barrio Logan and Logan Heights neighborhoods of San Diego. In addition, the ARB has conducted monitoring in five other communities in support of the community health program as required by SB 25. Efforts such as these will supplement our existing statewide TAC monitoring network, which was designed for regional rather than neighborhood assessments. Information on these and other studies are available at *www.arb.ca.gov/ch/programs/sb25/sb25.htm*. The ambient TAC air quality trends included in this chapter are based on ambient data collected during 1990 through 2003. At this time, ambient air quality data for diesel PM are not available. However, the ARB has made some estimates of ambient diesel PM concentrations, based on receptor modeling techniques. These estimates are included for comparison.

Statewide Health Risk and Community Health. In this almanac, health risk is presented on a pollutant-by-pollutant basis and on a cumulative basis, with a focus on cancer risk. Because the monitoring data represent general population exposures, the risk estimates represent general population impacts. Localized impacts may involve exposure to different toxic air contaminants with higher or lower concentrations than those represented by the ambient air monitoring data. The SB 25 study characterizes community health risks by focusing on localized impacts.

The cancer risk estimates presented in this almanac are calculated using an annual average concentration calculated as an average of the monthly means multiplied by a unit risk factor. The unit risk factor is expressed as the probability, or risk, of contracting cancer as a result of constant exposure to an ambient concentration of 1 microgram per cubic meter over a 70-year lifetime. The potential impacts for cancer are expressed as the risk of contracting cancer (or excess cancer cases) per million people exposed over a 70-year period. Table 5-1 lists the unit risk factor for each of the ten TACs presented in this almanac. The factors reflect only the inhalation pathway.

For all TACs except diesel PM (for which trends are based on modeling), trends were examined using monitoring data. To minimize the influences of weather on the trends, three-year average statewide

Toxic Air Contaminant Unit Risk Factors

Toxic Air Contaminant	Unit Risk/Million People*
Acetaldehyde	2.7
Benzene	29
1,3-Butadiene	170
Carbon Tetrachloride	42
Chromium, Hexavalent	150,000
para-Dichlorobenzene	11
Formaldehyde	6
Methylene Chloride	1
Perchloroethylene	5.9
Diesel Particulate Matter	300**

* The Unit Risk represents the number of excess cancers per million people per microgram per cubic meter TAC concentration over a 70-year, lifetime exposure.

** A diesel particulate matter unit risk value of 300 is used as a reasonable estimate in the *"Risk Reduction Plan to Reduce Particulate Matter Emissions from Diesel-Fueled Engines and Vehicles"* (ARB, October 2000).

Table 5-1

concentrations were calculated. The resulting average statewide concentrations were calculated. The resulting averages at the beginning and end of the period of data were compared to determine the trends. For most TACs, this meant that the average concentration for 1990-1992 was compared to that for 2001-2003. However, for acetaldehyde and formaldehyde the data prior to 1996 are not reliable, so for those compounds the average concentration for 1996-1998 was compared to that for 2001-2003. For carbon tetrachloride, hexavalent chromium, and *para*-dichlorobenzene, there may be only one or two years in the three year average between 1990 and 1992.

The downward concentration trends for the TACs are real, as there have been many control measures implemented to reduce emissions. However, the overall downward trend for some compounds may be different than shown here, for several reasons. First, low concentrations are under-reported for some compounds using the U.S. EPA-approved calibration method. For example, prior to 1996, ambient formaldehyde and acetaldehyde concentrations were under-reported. A method change in 1996 corrected the bias. Because the earlier data as reported in this almanac have not been corrected, the trends appear discontinuous. This may hold true for other gaseous compounds, as well. In contrast, benzene and 1,3-butadiene concentrations during previous years were also likely under-reported, especially at low concentrations. The ARB staff resolved this problem beginning in 1999. The ARB staff developed correction factors for these two TACs, and the pre-1999 data presented in this almanac reflect the correction. Finally, variations in meteorology affect the trends. For example, the latter years of the trend period had more rain than the earlier drought years (1990-1992), and the presence of rainfall tends to lower the ambient concentrations. This may further affect the downward trends.

Additional Information. Additional emissions and air quality data for the ten TACs in this almanac, as well as many other TACs, may be found by accessing the ARB website at *www.arb.ca.gov/html/aqe&m.htm*. The web data are updated periodically, as new information becomes available. More detailed information on the health effects of these compounds, as well as other TACs, can be found in an ARB report entitled: *"Toxic Air Contaminant Identification List - Summaries,"* dated September 1997. This report can be obtained from the ARB Public Information Office at (916) 322-2990 or by accessing the ARB website at *www.arb.ca.gov/toxics/id.htm*.

Acetaldehyde

2004 Statewide Emission Inventory

Acetaldehyde is a federal hazardous air pollutant (HAP). The ARB identified acetaldehyde as a TAC in April 1993 under Assembly Bill 2728. This bill required the ARB to identify all federal HAPs as TACs. In California, acetaldehyde is identified as a carcinogen. This compound also causes chronic non-cancer toxicity in the respiratory system.

Acetaldehyde is both directly emitted into the atmosphere and formed in the atmosphere as a result of photochemical oxidation. Sources of acetaldehyde include emissions from combustion processes such as exhaust from mobile sources and fuel combustion from stationary internal combustion engines, boilers, and process heaters. In California, photochemical oxidation is the largest source of acetaldehyde concentrations in the ambient air. Approximately 24 percent of the statewide acetaldehyde emissions can be attributed to on-road motor vehicles, with an additional 50 percent attributed to other mobile sources such as construction and mining equipment, aircraft, recreational boats, and agricultural equipment. Area-wide sources of emissions, which contribute 23 percent of the statewide acetaldehyde emissions, include the burning of wood in residential fireplaces and wood stoves. Stationary sources contribute three percent of the statewide acetaldehyde emissions. The primary stationary sources are manufacturers of miscellaneous food and kindred products and crude oil and natural gas extraction. The emissions from these sources are from fuel combustion.

Acetaldehyde		
Emissions Source	**tons/year**	**Percent State**
Stationary Sources	234	3%
Area-wide Sources	1671	23%
On-Road Mobile	1745	24%
Gasoline Vehicles	773	10%
Diesel Vehicles	972	13%
Other Mobile	3721	50%
Gasoline Fuel	806	11%
Diesel Fuel	2295	31%
Other Fuel	621	8%
Natural Sources	0	0%
Total Statewide	***7372***	***100%***

Table 5-2

2004 Top Ten Counties - Acetaldehyde

The top ten counties account for approximately 46 percent of the statewide acetaldehyde emissions. The South Coast Air Basin has four of the top ten counties: South Coast portion of Los Angeles County (13 percent of the emissions of acetaldehyde statewide), Orange County (four percent), South Coast portion of San Bernardino County (three percent), and South Coast portion of Riverside County (three percent). Collectively, approximately 23 percent of statewide acetaldehyde emissions occur in the South Coast Air Basin. San Diego County accounts for approximately seven percent. The five other counties in the top ten for acetaldehyde emissions are: Alameda, Santa Clara, Fresno, Sacramento and Kern (San Joaquin Valley portion). These five counties account for approximately 17 percent of statewide acetaldehyde emissions.

Acetaldehyde			
County	Air Basin	tons/year	Percent
Los Angeles	South Coast	922	13%
San Diego	San Diego	508	7%
Orange	South Coast	317	4%
Alameda	San Francisco Bay Area	303	4%
Santa Clara	San Francisco Bay Area	262	4%
Fresno	San Joaquin Valley	252	3%
Sacramento	Sacramento Valley	221	3%
Riverside	South Coast	205	3%
San Bernardino	South Coast	202	3%
Kern	San Joaquin Valley	195	3%

Table 5-3

Acetaldehyde

Air Quality and Health Risk

The ARB routinely monitors acetaldehyde concentrations in the ambient air at its network of toxic monitoring sites. The trend graph for acetaldehyde for the years 1990 through 2003 is shown in Figure 5-2. Except for a sharp drop in acetaldehyde levels during 1995, and a corresponding increase the following year, the trend graph shows a general downward trend throughout the period. There is, however, a slight upturn during 2000 to 2003.

Although data are shown for all years during 1990 through 2003, the values prior to 1996 are uncertain because the ARB analyzed ambient samples using a method that underestimated the actual concentrations. A method change in 1996 corrected this bias, however, the ARB was unable to develop a correction factor for the earlier data. While the data prior to the method change are included here for completeness, they are not directly comparable to data collected during the later years.

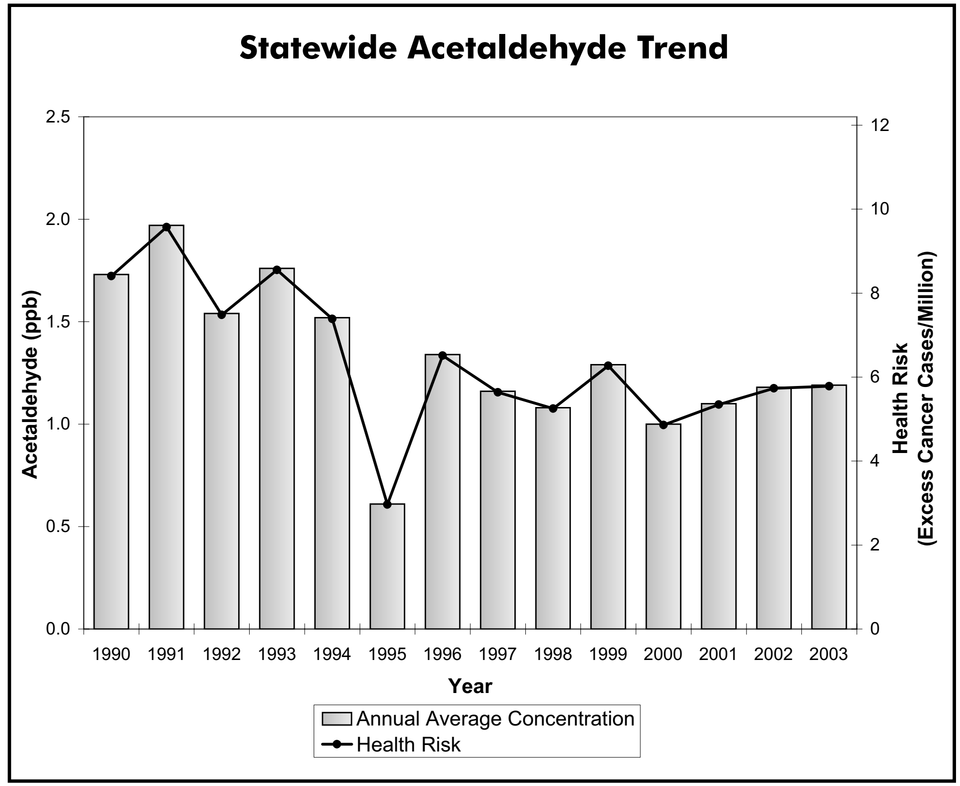

Figure 5-2

For all TACs except diesel PM (for which trends are based on modeling), trends were examined using monitoring data. To minimize the influences of weather on the trends, three-year average statewide concentrations were calculated. The resulting average statewide concentrations were calculated. The resulting averages at the beginning and end of the period of data were compared to determine the trends. For most TACs, this meant that the average concentration for 1990-1992 was compared to that for 2001-2003. However, for acetaldehyde and formaldehyde the data prior to 1996 are not reliable, so for those compounds the average concentration for 1996-1998 was compared to that for 2001-2003. As discussed above, years prior to 1996 were not used because they are uncertain. The result is a three percent decrease in acetaldehyde concentration and health risk. Health risk is based on the annual average concentration and represents the estimated number of excess cancer cases per million people exposed to the specified concentration for 70 years. During 2003, there was an estimated six excess cancer cases per million people. On an individual basis, the health risks from acetaldehyde are much lower than they are for some of the other toxic air contaminants. Among the ten compounds presented in this almanac, the health risk from acetaldehyde ranks eighth out of ten.

It is important to note that the health risk to acetaldehyde is not spread evenly throughout the State. This is common for almost all pollutants. The data reflect statewide averages, and do not consider local impacts. Therefore, some Californians may be exposed to near-source, or “hot spot” concentrations of acetaldehyde which are above the statewide annual average concentrations. “Hot spot” exposure may increase the potential cancer risk to individuals living near large combustion sources. Information collected under Assembly Bill 2588 (the Air Toxics “Hot Spots” Program) will be used during the risk management phase to help determine the priority and need for control of sources of acetaldehyde.

Another factor to consider is that the statewide averages reflect ambient outdoor concentrations. In general, acetaldehyde concentrations are higher indoors than outdoors, due in part to the abundance of combustion sources, such as cigarettes, fireplaces, and woodstoves.

Acetaldehyde is directly emitted and also occurs as a result of the photochemical oxidation of reactive organic gases (ROG). Over the years, stringent emission standards for new vehicles have resulted in steady declines in vehicular ROG emissions, including acetaldehyde, and NO_X emissions. Further reductions in ROG and NO_X are expected to result in a decline in directly emitted acetaldehyde due to vehicular emissions.

Benzene

2004 Statewide Emission Inventory

Benzene is highly carcinogenic and occurs throughout California. The ARB identified benzene as a TAC in January 1985 under California's TAC program (Assembly Bill 1807). In addition to being a carcinogen, benzene also has non-cancer health impacts. Brief inhalation exposure to high concentrations can cause central nervous system depression. Acute effects include central nervous system symptoms of nausea, tremors, drowsiness, dizziness, headache, intoxication, and unconsciousness.

Current estimates show that approximately 84 percent of the benzene emitted in California comes from motor vehicles, including evaporative leakage and unburned fuel exhaust. The predominant sources of total benzene emissions in the atmosphere are gasoline fugitive emissions and gasoline motor vehicle exhaust. Approximately 49 percent of the statewide benzene emissions can be attributed to on-road motor vehicles, with an additional 35 percent attributed to other mobile sources such as recreational boats, off-road recreational vehicles, and lawn and garden equipment. Currently, the benzene content of gasoline is less than one percent. Some of the benzene in the fuel is emitted from vehicles as unburned fuel. Benzene is also formed as a partial combustion product of larger aromatic fuel components. Industry-related stationary sources contribute 15 percent and area-wide sources contribute one percent of the statewide benzene emissions. The primary stationary sources of reported benzene emissions are crude petroleum and natural gas mining, petroleum refining, and electric generation. The primary area-wide sources include residential combustion of various types such as cooking and water heating. The primary natural sources are petroleum seeps that form where oil or natural gas emerge from subsurface sources to the ground or water surface.

Benzene		
Emissions Source	**tons/year**	**Percent State**
Stationary Sources	1929	15%
Area-wide Sources	115	1%
On-Road Mobile	6511	49%
Gasoline Vehicles	6246	47%
Diesel Vehicles	265	2%
Other Mobile	4594	35%
Gasoline Fuel	3707	28%
Diesel Fuel	624	5%
Other Fuel	262	2%
Natural Sources	35	0%
Total Statewide	***13183***	***100%***

Table 5-4

2004 Top Ten Counties - Benzene

The top ten counties account for approximately 56 percent of the statewide benzene emissions. The South Coast Air Basin has four of the top ten counties emitting benzene: South Coast portion of Los Angeles County (19 percent of the emissions of benzene statewide), Orange County (seven percent), South Coast portion of San Bernardino County (three percent), and South Coast portion of Riverside County (three percent). Collectively, approximately 32 percent of statewide benzene emissions occur in the South Coast Air Basin. Three counties in the San Francisco Air Basin contribute approximately 10 percent: Santa Clara County (four percent), Contra Costa County (three percent), and Alameda County (three percent). The three other counties in the top ten for benzene emissions are: San Diego, Kern, and Sacramento. These three counties account for approximately 16 percent of statewide benzene emissions.

Benzene			
County	Air Basin	tons/year	Percent
Los Angeles	South Coast	2446	19%
San Diego	San Diego	899	7%
Orange	South Coast	874	7%
Kern	San Joaquin Valley	757	6%
Santa Clara	San Francisco Bay Area	513	4%
San Bernardino	South Coast	413	3%
Alameda	San Francisco Bay Area	410	3%
Riverside	South Coast	396	3%
Sacramento	Sacramento Valley	355	3%
Contra Costa	San Francisco Bay Area	336	3%

Table 5-5

Benzene

Air Quality and Health Risk

The ARB has routinely monitored benzene concentrations in the ambient air for more than a decade. To examine the trend in benzene while minimizing the influences of weather on the trend, the statewide average benzene concentration for 1990-1992 was compared to that for 2001-2003. The result is a 72 percent decrease in both concentration and health risk. Figure 5-3 shows the annual average statewide benzene concentrations and the associated health risk from benzene alone. Ambient levels have shown generally steady improvement since 1990.

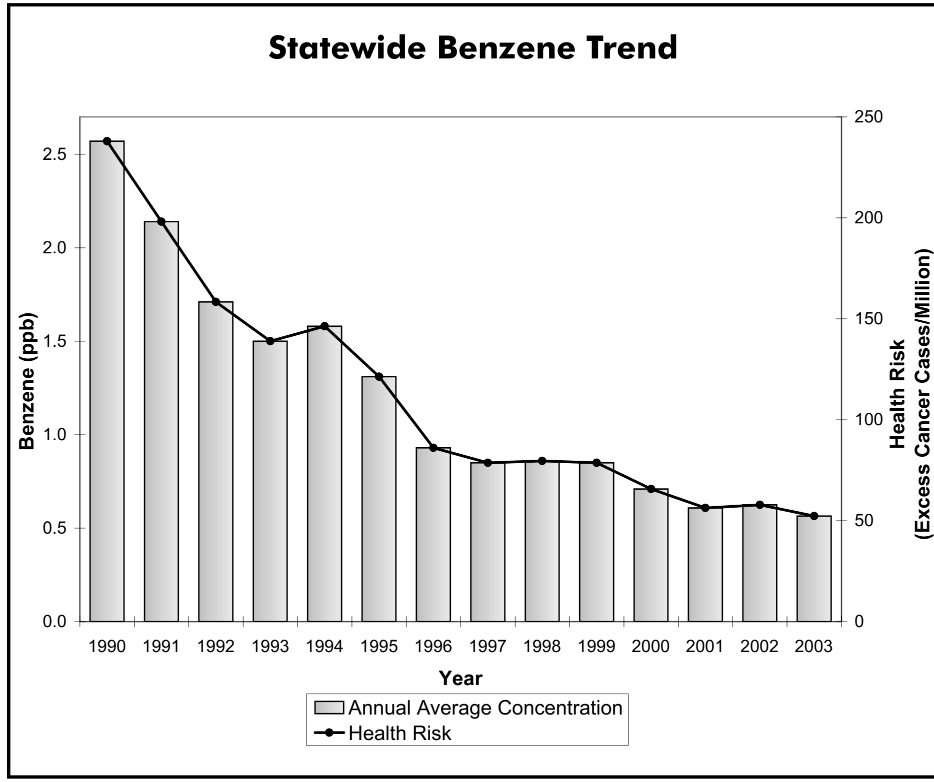

Figure 5-3

Health risk is based on the annual average concentration and represents the estimated number of excess cancer cases per million people exposed to the specified concentration level over a 70-year lifetime. From these data, it is apparent that benzene poses a substantial health risk. In fact, based on the statewide averages, benzene ranks second highest among the ten TACs presented in this almanac. During 2003, there was an estimated risk of 52 excess cancer cases per million people due to benzene. However, as with all air pollutants, the health risk is not spread evenly throughout the State. In some areas, the health risk is higher than the statewide average, while in other areas the health risk is lower. In general, ambient benzene concentrations and associated health risks tend to be higher in the more urbanized areas.

It is important to note that the ambient benzene concentrations have been corrected to provide a consistent long-term data record. Prior to 1999, the ARB analyzed samples using a single-point calibration of the gas chromatograph analyzers. While this method was approved by the U.S. EPA, it resulted in low concentrations being under-reported. Beginning January 1, 1999, new and more sophisticated computer software allowed the ARB to switch to a 3-point calibration of the analyzers. This improved measurement technique more accurately characterizes the ambient benzene, especially at low concentrations. However, concentrations measured using the 3-point calibration method are higher than those measured with the single-point calibration method. A year long study showed that the two measurement methods were highly correlated, and the ARB was able to develop a predictive relationship between the two. To avoid discontinuity in the trend data, the pre-1999 benzene data shown in Figure 5-3 have been adjusted according to these predictive equations, and they now reflect the results that would have been produced using the 3-point calibration method. Information about the specific study process and adjustment equations can be found on the "Laboratory Standard Operating Procedures for Ambient Air" page on the ARB website at *www.arb.ca.gov/aaqm/sop/summary/summary.htm*.

The ARB started to use a gas chromatography/mass spectrometry based method to analyze benzene in 2001 to fulfill a lower detection limit requirement for the SB 25 and Neighborhood Assessment Programs. The new method is also in line with the new U.S. EPA Urban Air Toxic Program being developed nationally. Measurements do not change substantially using the GC/MS method, so that no adjustment is needed to prior years' data.

Although the health risk from benzene is still substantial, emissions have been reduced significantly over the last decade, and will be reduced further in California through a progression of regulatory measures and control technologies. The Low Emission Vehicle (LEV) regulations have resulted in a significant reduction in exhaust and evaporative hydrocarbon emissions, including benzene. As the fleet turns over and new LEV technology vehicles are introduced into the fleet, emission reductions will continue. In 1996, the California Phase II Reformulated Gasoline Program was implemented statewide. Fuel reformulation has led to substanial decrease in the level of benzene from gasoline and vehicle exhaust emissions. Since motor vehicles continue to be the major source of benzene in the State, future efforts to improve fuel formulations, reduce vehicle exhaust emissions, and promote less polluting modes of transportation will likely continue to help reduce benzene emissions.

1,3-Butadiene

2004 Statewide Emission Inventory

The ARB identified 1,3-butadiene as a TAC in 1992. In California, 1,3-butadiene has been identified as a carcinogen. In addition, 1,3-butadiene vapors are mildly irritating to the eyes and mucous membranes and cause neurological effects at very high levels.

Most of the emissions of 1,3-butadiene are from incomplete combustion of gasoline and diesel fuels. Mobile sources account for approximately 83 percent of the total statewide emissions. Vehicles that are not equipped with functioning exhaust catalysts emit greater amounts of 1,3-butadiene than vehicles with functioning catalysts. Approximately 44 percent of the statewide 1,3-butadiene emissions can be attributed to on-road motor vehicles, with an additional 39 percent attributed to other mobile sources such as recreational boats, off-road recreational vehicles, and aircraft. Area-wide sources such as agricultural waste burning and open burning associated with forest management contribute approximately 13 percent. Stationary sources contribute less than one percent of the statewide 1,3-butadiene emissions. The primary stationary sources with reported 1,3-butadiene emissions include petroleum refining, manufacturing of synthetics and man-made materials, and oil and gas extraction. The primary natural sources are wildfires.

1,3-Butadiene		
Emissions Source	**tons/year**	**Percent State**
Stationary Sources	23	1%
Area-wide Sources	391	13%
On-Road Mobile	1347	44%
Gasoline Vehicles	1322	44%
Diesel Vehicles	25	1%
Other Mobile	1186	39%
Gasoline Fuel	893	29%
Diesel Fuel	59	2%
Other Fuel	234	8%
Natural Sources	82	3%
Total Statewide	***3030***	***100%***

Table 5-6

2004 Top Ten Counties - 1,3-Butadiene Emissions

The top ten counties account for approximately 49 percent of the statewide 1,3-butadiene emissions. The South Coast Air Basin contribute approximately 26 percent: Los Angeles County (16 percent), Orange County (five percent), Riverside County (three percent), and South Coast portion of San Bernardino County (three percent). San Diego County accounts for approximately seven percent. Two counties in the San Joaquin Valley Air Basin contribute seven percent of the 1,3-butadiene: Tulare County (four percent), and Fresno County (three percent). The other counties in the top ten for 1,3-butadiene emissions are: Santa Clara, Alameda and Sacramento.

1,3-Butadiene			
County	Air Basin	tons/year	Percent
Los Angeles	South Coast	477	16%
San Diego	San Diego	215	7%
Orange	South Coast	159	5%
Tulare	San Joaquin Valley	107	4%
Santa Clara	San Francisco Bay Area	102	3%
San Bernardino	South Coast	93	3%
Alameda	San Francisco Bay Area	88	3%
Riverside	South Coast	86	3%
Fresno	San Joaquin Valley	80	3%
Sacramento	Sacramento Valley	72	2%

Table 5-7

1,3-Butadiene

Air Quality and Health Risk

The ARB routinely monitors for 1,3-butadiene at its statewide air toxics monitoring network. Figure 5-4 shows the annual average statewide 1,3-butadiene concentrations and the associated health risk from this TAC alone. The data show a general downward trend, with some variability. To examine the trend in 1,3-butadiene while minimizing the influences of weather on the trend, the statewide average 1,3-butadiene concentration for 1990-1992 was compared to that for 2001-2003. The result is a 57 percent decrease in both concentration and health risk. Despite this substantial drop, the health risk from this compound remains relatively high. In 2003, there was an estimated risk of 44 excess cancer cases per million people. Of the ten compounds presented in this almanac, the average statewide health risk from 1,3-butadiene ranks third. Again, it is important to note that the data shown here reflect statewide averages. They do not consider local impacts, which may be higher or lower.

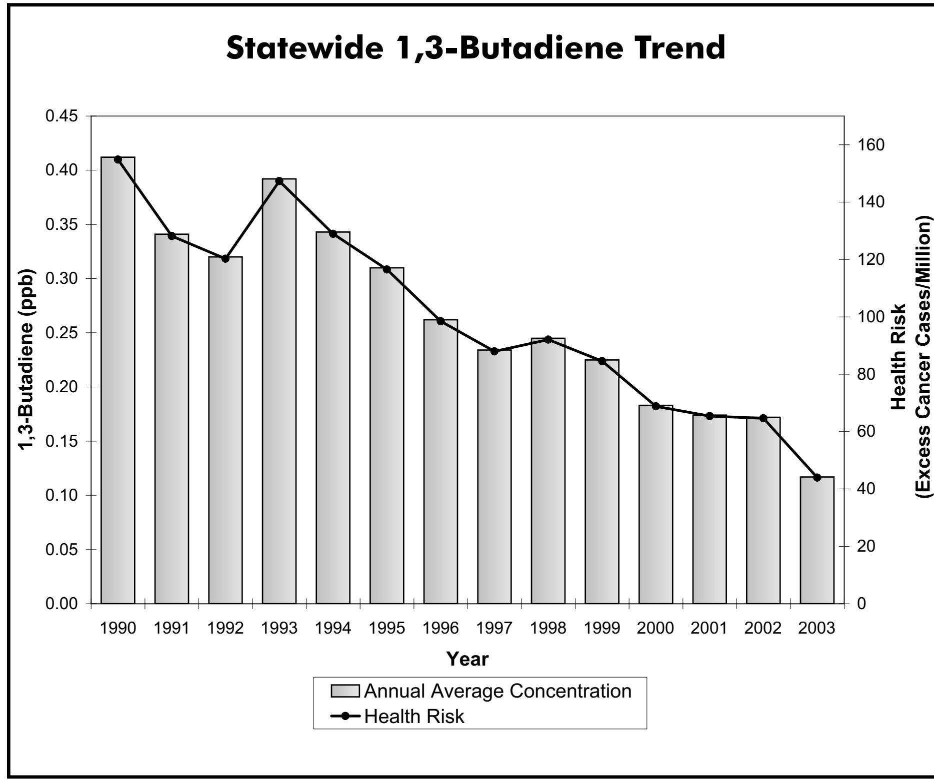

Figure 5-4

Similar to benzene, the ARB analyzed 1,3-butadiene samples using a single-point calibration of the gas chromatograph analyzers prior to 1999. While this method was approved by the U.S. EPA, it resulted in low concentrations being under-reported. Beginning January 1, 1999, new and more sophisticated computer software allowed the ARB to switch to a 3-point calibration of the analyzers. This improved measurement technique more accurately characterizes the ambient 1,3-butadiene, especially at low concentrations. However, concentrations measured using the 3-point calibration method are higher than those measured with the single-point calibration method. A year-long ARB study showed that the two measurement methods were highly correlated, and the ARB was able to develop a predictive relationship between them. To avoid discontinuity in the trend data, the pre-1999 1,3-butadiene data shown in Figure 5-4 have been adjusted according to these predictive equations and now reflect the results that would have been produced using the 3-point calibration method. Information about the specific study process and adjustment equations can be found on the "Laboratory Standard Operating Procedures for Ambient Air" page on the ARB website at *www.arb.ca.gov/aaqm/sop/summary/summary.htm*.

Similar to benzene, the ARB started to use a gas chromatography/mass spectrometry based method to analyze 1,3-butadiene in 2001 to fulfill a lower detection limit requirement for the SB 25 and Neighborhood Assessment Programs. The new method is also in line with the new U.S. EPA Urban Air Toxic Program being developed nationally. Measurements do not change substantially using the GC/MS method, so that no adjustment is needed to prior years' data.

In California, the majority of 1,3-butadiene emissions are from incomplete combustion of gasoline and diesel fuels. The ARB adopted Low Emission Vehicles (LEV)/Clean Fuels regulations in 1990 and Phase II reformulated gasoline regulations in 1991. The LEV regulations are expected to continue to reduce 1,3- butadiene emissions from cars and light-duty trucks as the fleet turns over and new low emission vehicles are introduced into the fleet.

Carbon Tetrachloride

2004 Statewide Emission Inventory

The ARB identified carbon tetrachloride as a Toxic Air Contaminant in 1987 under California's TAC program (AB 1807). In California, carbon tetrachloride has been identified as a carcinogen. Carbon tetrachloride is also a central nervous system depressant and mild eye and respiratory tract irritant.

The primary stationary sources reporting emissions of carbon tetrachloride include chemical and allied product manufacturers and petroleum refineries. In the past, carbon tetrachloride was used for dry cleaning and as a grain-fumigant. Usage for these purposes is no longer allowed in the United States. Carbon tetrachloride has not been registered for pesticidal use in California since 1987. Also, the use of carbon tetrachloride in products to be used indoors has been discontinued in the United States. The statewide emissions of carbon tetrachloride are small (about 2.30 tons per year), and background concentrations account for most of the health risk.

Carbon Tetrachloride		
Emissions Source	**tons/year**	**Percent State**
Stationary Sources	2.30	100%
Area-wide Sources	0	0%
On-Road Mobile	0	0%
Gasoline Vehicles	0	0%
Diesel Vehicles	0	0%
Other Mobile	0	0%
Gasoline Fuel	0	0%
Diesel Fuel	0	0%
Other Fuel	0	0%
Natural Sources	0	0%
Total Statewide	***2.30***	***100%***

Table 5-8

2004 Top Ten Counties - Carbon Tetrachloride

The top two counties account for 80 percent of the statewide carbon tetrachloride emissions. Contra Costa County (San Francisco Bay Area Air Basin) accounts for approximately 64 percent, and Los Angeles County (South Coast Air Basin Portion) accounts for approximately 16 percent of the emissions of carbon tetrachloride statewide. Carbon tetrachloride emissions in the South Coast Air Basin portion of Los Angeles County have decreased from previous editions of the almanac due to the closure of a major facility in that area. Although the percentages for these two counties are high, the emissions are very small (two tons or less per year in each county). The eight other counties in the top ten contribute approximately 18 percent of statewide carbon tetrachloride emissions.

Carbon Tetrachloride			
County	**Air Basin**	**tons/year**	**Percent**
Contra Costa	San Francisco Bay Area	1.46	64%
Los Angeles	South Coast	0.37	16%
San Diego	San Diego	0.12	5%
San Bernardino	Mojave Desert	0.10	4%
Ventura	South Central Coast	0.05	2%
Sacramento	Sacramento Valley	0.05	2%
Riverside	Mojave Desert	0.04	2%
Alameda	San Francisco Bay Area	0.03	1%
Sonoma	San Francisco Bay Area	0.02	1%
Kern	Mojave Desert	0.02	1%

Table 5-9

Carbon Tetrachloride

Air Quality and Health Risk

The ARB routinely monitors carbon tetrachloride at its statewide air toxics monitoring network. Figure 5-5 shows the annual average statewide concentrations and the associated health risk from carbon tetrachloride alone. As with a number of other TACs, there are several years of incomplete data for carbon tetrachloride. Based on the data that are available, the ambient concentrations and health risk dropped between 1990 and 1996, and then there was a substantial increase in values for 1998. During 2000 through 2003, values fluctuated slightly, and that may be due in part to meteorological fluctuations rather than changes in emissions.

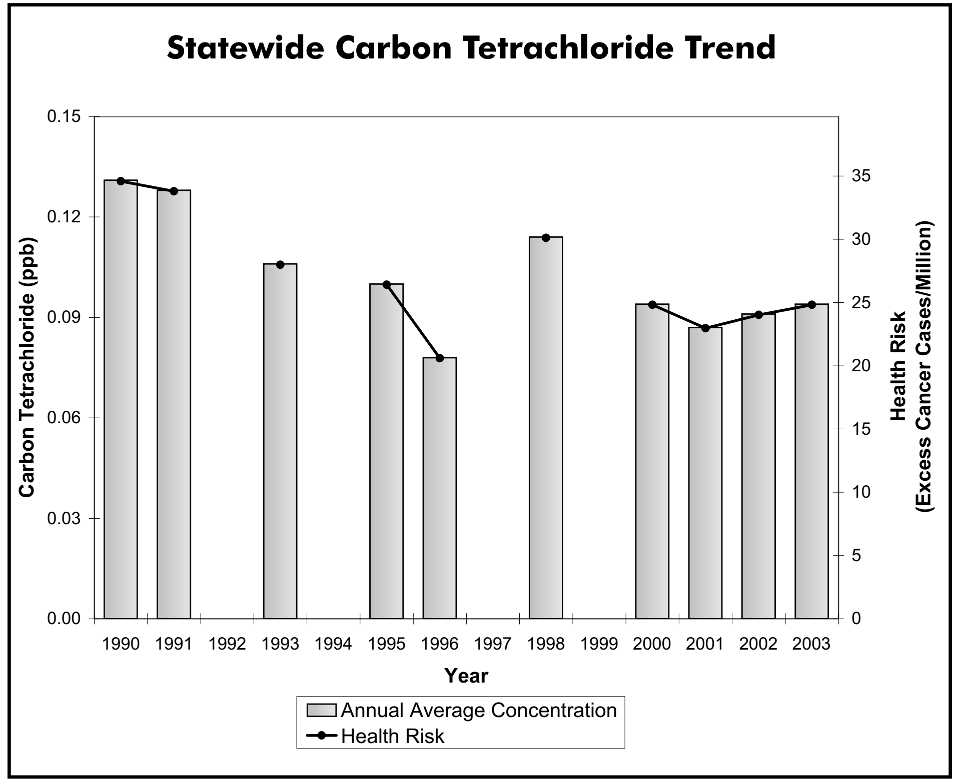

Figure 5-5

Based on data from sites in the TAC monitoring network, the 2003 statewide average carbon tetrachloride concentration and the associated health risk were about 30 percent lower than the peak in 1990. Health risk is based on the annual average concentration and represents the estimated number of excess cancer cases per million people exposed to the specified concentration for 70 years. During 2003, there was an estimated risk of 25 excess cancer cases per million people. The health risk of this TAC ranks fourth among the ten compounds presented in this almanac. As with all air pollutants, the health risk is not spread evenly throughout the State. In some areas, the health risk is higher than the statewide average, while in other areas the health risk is lower.

Unlike many of the other TACs, carbon tetrachloride is emitted primarily by sources other than motor vehicles, and there are virtually no emissions within California. However, because carbon tetrachloride persists in the atmosphere for many years (the estimated atmospheric lifetime is 50 years), background concentrations still pose a health risk.

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Chromium, Hexavalent

2004 Statewide Emission Inventory

Hexavalent chromium was identified as a Toxic Air Contaminant in 1986 under California's TAC program (AB 1807). In California, hexavalent chromium has been identified as a carcinogen. There is epidemiological evidence that exposure to inhaled hexavalent chromium may result in lung cancer. The principal acute effects of hexavalent chromium are renal toxicity, gastrointestinal hemorrhage, and intravascular hemolysis.

Chrome plating is a primary source of hexavalent chromium emissions in the State. Hexavalent chromium emissions from plating have declined significantly from previous editions of the almanac due to many platers switching to the use of trivalent chromium in place of hexavalent chromium. Chromic acid anodizing is another industrial metal finishing process which uses hexavalent chromium. A third source of hexavalent chromium emissions is the firebrick lining of glass furnaces. In California, stationary sources are estimated to emit slightly less than one ton annually of hexavalent chromium. Emissions from these sources were obtained from facilities under the Air Toxics Hot Spots Act of 1987. This act required facilities to estimate toxics and potential toxics emissions, including hexavalent chromium. Approximately 0.13 tons of hexavalent chromium are emitted by gasoline motor vehicles. Other mobile sources such as trains and ships contribute approximately 0.79 tons of hexavalent chromium annually.

Chromium, Hexavalent		
Emissions Source	**tons/year**	**Percent State**
Stationary Sources	0.82	48%
Area-wide Sources	0	0%
On-Road Mobile	0.13	7%
Gasoline Vehicles	0.12	7%
Diesel Vehicles	< .01	0%
Other Mobile	0.79	46%
Gasoline Fuel	0.15	9%
Diesel Fuel	< .01	0%
Other Fuel	0.63	37%
Natural Sources	0	0%
Total Statewide	***1.73***	***100%***

Table 5-10

2004 Top Ten Counties - Chromium, Hexavalent

Four counties account for approximately 57 percent of the statewide hexavalent chromium emissions: Los Angeles County portion of the South Coast Air Basin (21 percent), Mojave Desert portion of Kern County (17 percent of the emissions of hexavalent chromium statewide), San Diego County (14 percent), and Toulumne County (five percent). Collectively, approximately 29 percent of statewide hexavalent chromium emissions occur in the South Coast Air Basin. Two counties in the San Joaquin Valley Air Basin contribute approximately six percent: Fresno County (three percent), and the San Joaquin Valley portion of Kern County (two percent).

Chromium, Hexavalent			
County	Air Basin	tons/year	Percent
Los Angeles	South Coast	0.37	21%
Kern	Mojave Desert	0.29	17%
San Diego	San Diego	0.24	14%
Tuolumne	Mountain Counties	0.08	5%
Orange	South Coast	0.05	3%
Fresno	San Joaquin Valley	0.05	3%
San Bernardino	South Coast	0.04	3%
Kern	San Joaquin Valley	0.04	2%
Sonoma	North Coast	0.04	2%
Riverside	South Coast	0.04	2%

Table 5-11

Chromium, Hexavalent

Air Quality and Health Risk

Unlike the other TACs discussed in this almanac, hexavalent chromium is the cation of a metal salt rather than a gas. Statewide annual averages and health risk estimates are available for 1992 through 2003. Prior to 1992, a different measurement method was used. With this method, some of the hexavalent chromium was transformed into trivalent chromium on the collection filter. As a result, the hexavalent chromium concentrations were underestimated, and these data are not included in this almanac. Since 1992, a new and more accurate method has been used.

The statewide annual average concentrations and associated health risks are shown in Figure 5-6. Both show a general downward trend, with the exception of 1995. The high 1995 value is driven in part by an extremely high annual average for the Burbank site in the South Coast Air Basin. However, a number of other sites also had higher concentrations in 1995 than in other years. Hexavalent chromium values dropped substantially after 1995, and the decrease coincided with the complete implementation of the chrome plating and the chromate-treated cooling tower control measures. Between 1996 and 1999, slight improvements continued, and values in 2000 and 2001 were slightly elevated over 1999 and 2002 levels.

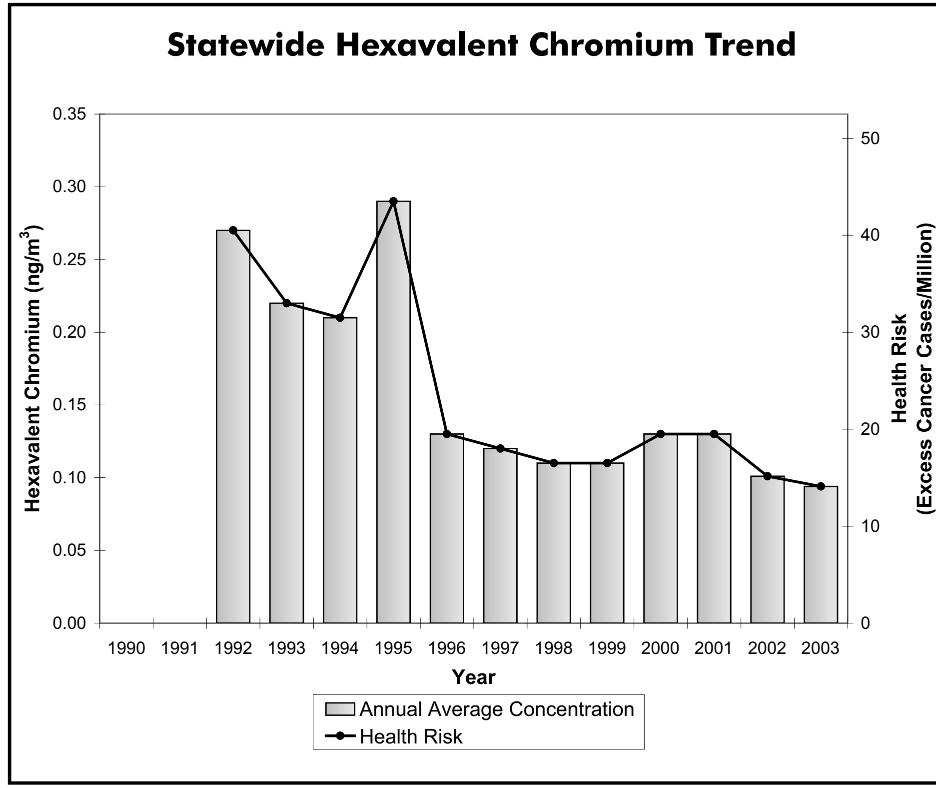

Figure 5-6

To examine the trend in hexavalent chromium while minimizing the influences of weather on the trend, the average hexavalent chromium concentration for 1990-1992 was compared to that for 2001-2003. The result is a 60 percent decrease in both concentration and health risk. In 2003, there was an estimated 14 excess cancer cases per million people, based on the annual average concentration. Based on data for all ten TACs presented in this almanac, hexavalent chromium ranks sixth in terms of health risk. Health risk is based on the annual average concentration and represents the estimated risk of excess cancer cases per million people exposed over a 70-year lifetime at the specified concentration level. It is important to remember that since hexavalent chromium exposure and health impact occur on a neighborhood scale, actual health risk can be higher in some areas than the statewide average, and lower in other areas.

During 1998 through 2001, a very high percentage of the measured values were below the Limit of Detection (LOD), which is the lowest concentration that can be reliably measured. In calculating an annual average, values below the LOD are assumed equal to 0.1 nanograms per cubic meter (ng/m^3), which is one-half the LOD of 0.2 ng/m^3. The one-half of LOD approach applies to all other TACs when their measurements are below their respective LODs. It is a good estimate for some TACs, however, it is uncertain for hexavalent chromium due to the high number of very low concentrations. This approach continues to apply to hexavalent chromium for consistency. Starting on January 1, 2002, hexavalent chromium is being analyzed by compositing quarterly samples by site. Although the new method decreases the number of samples, it increases the sensitivity of the instrument by lowering the LOD from 0.2 ng/m^3 to 0.06 ng/m^3.

Implementation of a series of control measures has helped reduce ambient concentrations and associated health risks from hexavalent chromium. In 1988, the ARB adopted an airborne toxic control measure to reduce emissions of hexavalent chromium from chrome plating and chromic acid anodizing operations. The control measure reduced hexavalent chromium emissions from these operations by over 90 percent. In the past, compounds containing hexavalent chromium, such as sodium dichromate or lead chromate, were added to cooling tower water to control corrosion in the towers and associated heat exchangers. The ARB adopted a statewide airborne toxic control measure in 1989 that prohibits the use of hexavalent chromium in cooling towers. In September 2001, the ARB approved an air toxic control measure banning the use of both hexavalent chromium and cadmium in motor vehicle and mobile equipment coatings. The measure became effective January 1, 2003, and allows a sell-through period to deplete existing inventories. Statewide, ARB estimates that 99 percent of auto body repair and refinishing facilities already use chromium-free and cadmium-free coatings. However, this rule will ensure additional reductions in hexavalent chromium exposures near those remaining facilities that do not use chromium-free and cadmium-free coatings.

para-Dichlorobenzene

2004 Statewide Emission Inventory

The ARB identified *para*-dichlorobenzene as a TAC in April 1993 under AB 2728. This bill required the ARB to identify, by regulation, all federal hazardous air pollutants as TACs. In California, *para*-dichlorobenzene has been identified as a carcinogen. In addition to the carcinogenic impact, long-term inhalation exposure may affect the liver, skin, and central nervous system in humans.

The primary area-wide sources that have reported emissions of *para*-dichlorobenzene include consumer products such as non-aerosol insect repellants and solid/gel air fresheners. These sources contribute approximately 99 percent of the statewide *para*-dichlorobenzene emissions. Stationary sources contribute approximately 1 percent. The primary stationary sources include plating and polishing of fabricated metal products, crude petroleum and natural gas extraction, and sanitary services.

para-DiChlorobenzene		
Emissions Source	**tons/year**	**Percent State**
Stationary Sources	15	1%
Area-wide Sources	1864	99%
On-Road Mobile	0	0%
Gasoline Vehicles	0	0%
Diesel Vehicles	0	0%
Other Mobile	0	0%
Gasoline Fuel	0	0%
Diesel Fuel	0	0%
Other Fuel	0	0%
Natural Sources	0	0%
Total Statewide	***1879***	***100%***

Table 5-12

2004 Top Ten Counties - *para*-Dichlorobenzene

The top ten counties account for approximately 69 percent of the statewide *para*-dichlorobenzene emissions. The South Coast Air Basin has four of the top ten counties: South Coast portion of Los Angeles County (26 percent of the emissions of *para*-dichlorobenzene statewide), Orange County (eight percent), South Coast portion of San Bernardino County (four percent), and South Coast portion of Riverside County (four percent). Collectively, approximately 42 percent of statewide *para*-dichlorobenzene emissions occur in the South Coast Air Basin. San Diego County contributes approximately nine percent. Three counties in the San Francisco Bay Area Air Basin contribute approximately 12 percent: Santa Clara County (five percent), Alameda County (four percent), and Contra Costa County (three percent). The two other counties in the top ten for *para*-dichlorobenzene emissions are Sacramento and Fresno.

para-DiChlorobenzene			
County	**Air Basin**	**tons/year**	**Percent**
Los Angeles	South Coast	497	26%
San Diego	San Diego	161	9%
Orange	South Coast	156	8%
Santa Clara	San Francisco Bay Area	93	5%
Alameda	San Francisco Bay Area	78	4%
San Bernardino	South Coast	72	4%
Riverside	South Coast	70	4%
Sacramento	Sacramento Valley	67	4%
Contra Costa	San Francisco Bay Area	51	3%
Fresno	San Joaquin Valley	46	2%

Table 5-13

para-Dichlorobenzene

Air Quality and Health Risk

The ARB routinely monitors *para*-dichlorobenzene in ambient air, and statewide annual average concentrations and health risk estimates are available for 1991 through 2003, with the exception of 1998 and 1999. No summary data are available for these years because of problems with laboratory equipment and associated data reliability. The trend graph for *para*-dichlorobenzene, shown in Figure 5-7, shows generally constant values throughout 1991 to 2003, with slightly lower values in 1994, 1996, and 2000, and an upturn in 2001 through 2003.

Health risk is based on the annual average concentration and represents the estimated number of excess cancer cases per million people exposed to the specified concentration for 70 years. During 2003, there was an estimated risk of 11 excess cancer cases per million people from this compound alone. Based on this, *para*-dichlorobenzene ranks seventh out of the ten compounds presented in this almanac. It is important to remember that, as with all air pollutants, the data shown here reflect statewide averages. They do not consider local impacts, which may be higher or lower.

Similar to hexavalent chromium, a very high percentage of the measured values were below the Limit of Detection (LOD), which is the lowest concentration that can be reliably measured. In calculating an annual average, values below the LOD are assumed equal to 0.15 parts per billion (ppb), which is one-half the LOD of 0.3 ppb. The one-half of LOD approach applies to all other TACs when their measurements are below the LOD. It is a good estimate for some TACs, however, it is uncertain for *para*-dichlorobenzene due to the large number of samples with very low concentrations. However, for consistency, this approach continues to apply to *para*-dichlorobenzene.

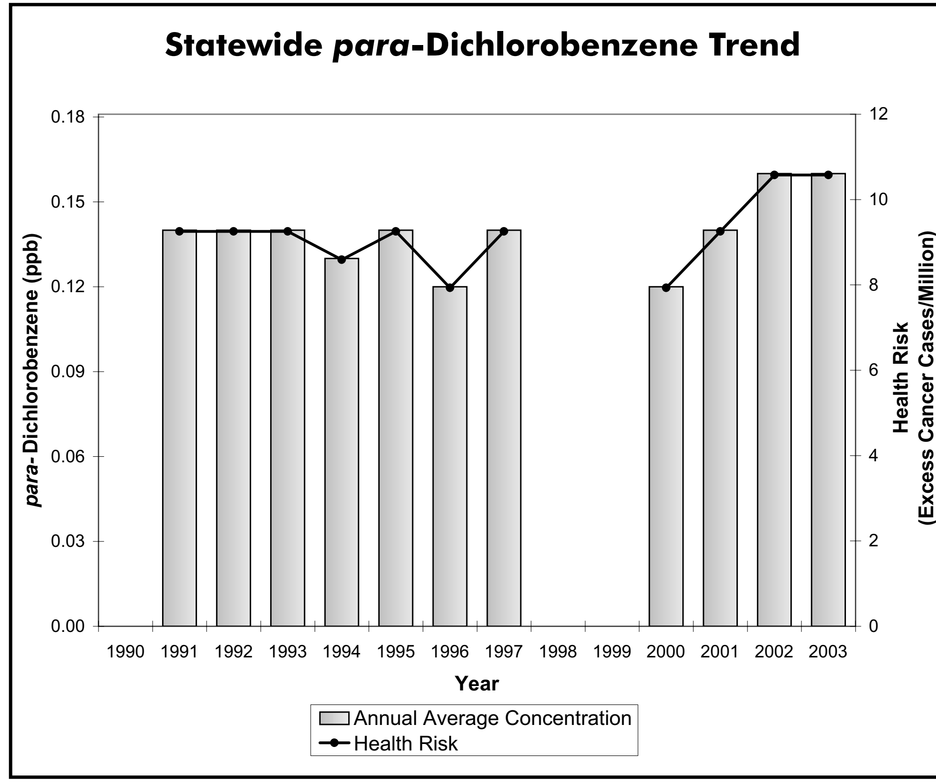

Figure 5-7

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Formaldehyde

2004 Statewide Emission Inventory

The ARB identified formaldehyde as a TAC in 1992 under California's TAC program (AB 1807). In California, formaldehyde has been identified as a carcinogen. Chronic exposure is associated with respiratory symptoms and eye, nose, and throat irritation.

Formaldehyde is both directly emitted into the atmosphere and formed in the atmosphere as a result of photochemical oxidation. Photochemical oxidation is the largest source of formaldehyde concentrations in California ambient air. Formaldehyde is a product of incomplete combustion. One of the primary sources of directly-emitted formaldehyde is vehicular exhaust. Formaldehyde is used in resins, can be found in many consumer products as an antimicrobial agent, and is also used in fumigants and soil disinfectants. About 76 percent of direct formaldehyde emissions are estimated to come from the combustion of fossil fuels from mobile sources. Approximately 27 percent of the total statewide formaldehyde emissions can be attributed to on-road motor vehicles, with an additional 49 percent attributed to other mobile sources such as aircraft, recreational boats, and construction and mining equipment. Area-wide sources contribute approximately 10 percent and stationary sources contribute approximately 14 percent of the statewide formaldehyde emissions. The primary area-wide sources in California of formaldehyde emissions include the wood burning in residential fireplaces and wood stoves.

Formaldehyde		
Emissions Source	**tons/year**	**Percent State**
Stationary Sources	2828	14%
Area-wide Sources	2015	10%
On-Road Mobile	5459	27%
Gasoline Vehicles	3514	17%
Diesel Vehicles	1946	10%
Other Mobile	9949	49%
Gasoline Fuel	3338	16%
Diesel Fuel	4593	23%
Other Fuel	2018	10%
Natural Sources	0	0%
Total Statewide	***20251***	***100%***

Table 5-14

2004 Top Ten Counties - Formaldehyde

The top ten counties account for approximately 51 percent of the statewide formaldehyde emissions. The South Coast Air Basin has four of the top ten counties emitting formaldehyde: South Coast portion of Los Angeles County (15 percent of the emissions of formaldehyde statewide), Orange County (five percent), South Coast portion of San Bernardino County (three percent), and South Coast portion of Riverside County (three percent). Collectively, approximately 26 percent of statewide formaldehyde emissions occur in the South Coast Air Basin. The six other counties in the top ten for formaldehyde emissions are: San Diego, Kern, Santa Clara, Alameda, Fresno, and Sacramento. These six counties account for approximately 25 percent of statewide formaldehyde emissions.

Formaldehyde			
County	**Air Basin**	**tons/year**	**Percent**
Los Angeles	South Coast	3098	15%
San Diego	San Diego	1324	7%
Kern	San Joaquin Valley	1210	6%
Orange	South Coast	1020	5%
Santa Clara	San Francisco Bay Area	709	4%
Alameda	San Francisco Bay Area	636	3%
Riverside	South Coast	599	3%
Fresno	San Joaquin Valley	590	3%
San Bernardino	South Coast	564	3%
Sacramento	Sacramento Valley	541	3%

Table 5-15

Formaldehyde

Air Quality and Health Risk

The ARB routinely monitors formaldehyde concentrations in the ambient air, and statewide annual average concentrations and associated health risk are available for 1990 through 2003. However, values prior to 1996 are uncertain because the data were based on a method that underestimated the actual concentrations. A method change in 1996 corrected this problem, but a correction factor could not be developed for the earlier data. While the data prior to the method change are included here for completeness, they are not directly comparable to data collected during the later years.

The trend graph for formaldehyde, shown in Figure 5-8, shows a great deal of variability. During 1990 through 1992, there is a general drop in ambient concentrations, and then values steadily increase from 1993 through 1996. During 1996 through 2003, values fluctuate, but do not change substantially. It may take a few years to see if a long-term trend exists. To examine the trend in formaldehyde using available data while minimizing the influences of weather on the trend, the statewide average formaldehyde concentration for 1996-1998 was compared to that for 2001-2003 (note that formaldehyde data prior to 1996 are not reliable). The result is a 10 percent increase in both concentration and health risk. Note that health risk is based on the annual average concentration and represents the estimated number of excess cancer cases per million people exposed to the specified concentration for 70 years. During 2003, there was an estimated risk of 23 excess cancer cases per million people from formaldehyde alone. Based on data for all ten TACs presented in this almanac, formaldehyde ranks fifth in terms of health risk. As with other TACs, the health risk is not spread evenly throughout the State, so in some areas the health risk is higher than the statewide average while in other areas, the health risk is lower.

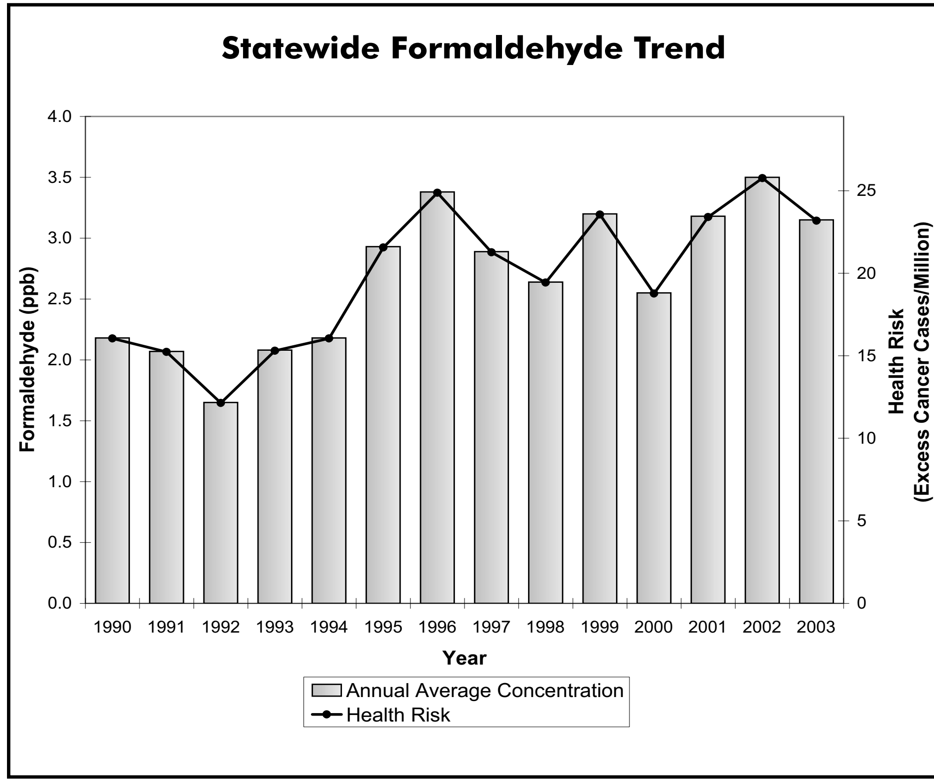

Figure 5-8

Although formaldehyde is emitted by both stationary and mobile sources, mobile sources are, by far, the largest contributors. The ARB adopted the Low Emissions/Clean Fuels Regulations in 1990, and these regulations are expected to continue to reduce formaldehyde emissions from cars and light-duty trucks.

While ambient outdoor formaldehyde concentrations are expected to decline, formaldehyde concentrations indoors are generally higher.

This is because many building materials, consumer products, and fabrics emit formaldehyde. As a result, indoor formaldehyde levels are expected to remain higher than outdoor levels because of new materials brought into homes, as a consequence of remodeling or purchasing new furnishings. Other indoor combustion sources such as wood and gas stoves, kerosene heaters, and cigarettes also contribute to indoor formaldehyde levels, although intermittently.

Methylene Chloride

2004 Statewide Emission Inventory

The ARB identified methylene chloride as a Toxic Air Contaminant in 1987 under California's TAC program. In California, methylene chloride has been identified as a carcinogen. In addition, chronic exposure can lead to bone marrow, hepatic, and renal toxicity.

Methylene chloride is used as a solvent, a blowing and cleaning agent in the manufacture of polyurethane foam and plastic fabrication, and as a solvent in paint stripping operations. Although methylene chloride is used in some aerosol consumer products (e.g., aerosol paints and automotive products), most consumer product manufacturers have voluntarily phased out its use. Paint removers account for the largest use of methylene chloride in California, where methylene chloride is the main ingredient in many paint stripping formulations. Plastic product manufacturers, manufacturers of synthetics, and aircraft and parts manufacturers are stationary sources reporting emissions of methylene chloride. These sources contribute approximately 52 percent of the statewide methylene chloride emissions. Area-wide sources contribute approximately 48 percent. The primary area-wide sources include consumer products such as paint removers and strippers and automotive brake cleaners.

Methylene Chloride		
Emissions Source	**tons/year**	**Percent State**
Stationary Sources	3995	52%
Area-wide Sources	3642	48%
On-Road Mobile	0	0%
Gasoline Vehicles	0	0%
Diesel Vehicles	0	0%
Other Mobile	0	0%
Gasoline Fuel	0	0%
Diesel Fuel	0	0%
Other Fuel	0	0%
Natural Sources	0	0%
Total Statewide	***7637***	***100%***

Table 5-16

2004 Top Ten Counties - Methylene Chloride

The top ten counties account for approximately 76 percent of the statewide methylene chloride emissions. The South Coast Air Basin has four of the top ten counties emitting methylene chloride: South Coast portion of Los Angeles County (35 percent of the emissions of methylene chloride statewide), Orange County (14 percent), South Coast portion of San Bernardino County (six percent), and South Coast portion of Riverside County (three percent). Collectively, approximately 58 percent of statewide methylene chloride emissions occur in the South Coast Air Basin. Three counties in the San Francisco Bay Area Air Basin contribute approximately nine percent: Santa Clara County (four percent), Alameda County (three percent), and Contra Costa (two percent). The three other counties in the top ten for methylene chloride emissions are: San Diego, Sacramento, and Ventura. Together, these three counties account for approximately nine percent of statewide methylene chloride emissions.

Methylene Chloride			
County	Air Basin	tons/year	Percent
Los Angeles	South Coast	2647	35%
Orange	South Coast	1083	14%
San Bernardino	South Coast	472	6%
San Diego	San Diego	378	5%
Santa Clara	San Francisco Bay Area	324	4%
Riverside	South Coast	266	3%
Alameda	San Francisco Bay Area	259	3%
Sacramento	Sacramento Valley	176	2%
Ventura	South Central Coast	158	2%
Contra Costa	San Francisco Bay Area	131	2%

Table 5-17

Methylene Chloride

Air Quality and Health Risk

The ARB routinely monitors methylene chloride in the ambient air. The trend graph in Figure 5-9 shows some variability, particularly during the early years. However, there is an overall downward trend, and the drop during 2001 through 2003 is substantial. To examine the trend in methylene chloride while minimizing the influences of weather on the trend, the statewide average methylene chloride concentration for 1990-1992 was compared to that for 2001-2003. The result is a 70 percent decrease in both concentration and health risk. Of the ten compounds presented in this almanac, methylene chloride presents the lowest health risk, on a statewide basis. However, any level of risk is a concern from a public health standpoint. During 2003, there was an estimated risk of one excess cancer case per million people. Health risk is based on the annual average concentration and represents the estimated number of excess cancer cases per million people exposed to the specified concentration for 70 years.

In California, paint removers account for the largest use of methylene chloride, which is the primary ingredient in paint stripping formulations used for industrial, commercial, military, and domestic applications. Because methylene chloride is also a constituent in many consumer products, including aerosol paints and automotive products, short-term indoor concentrations may be several orders of magnitude higher than the ambient outdoor concentrations. Many manufacturers of consumer products are voluntarily phasing-out their use of methylene chloride. In addition, in the case of aerosol paints, use will be restricted by a provision in the ARB's "Regulation for Reducing Volatile Organic Compound (VOC) Emissions from Aerosol Coating Products," adopted in March 1995. These regulations should help to further reduce ambient outdoor concentrations and health risks.

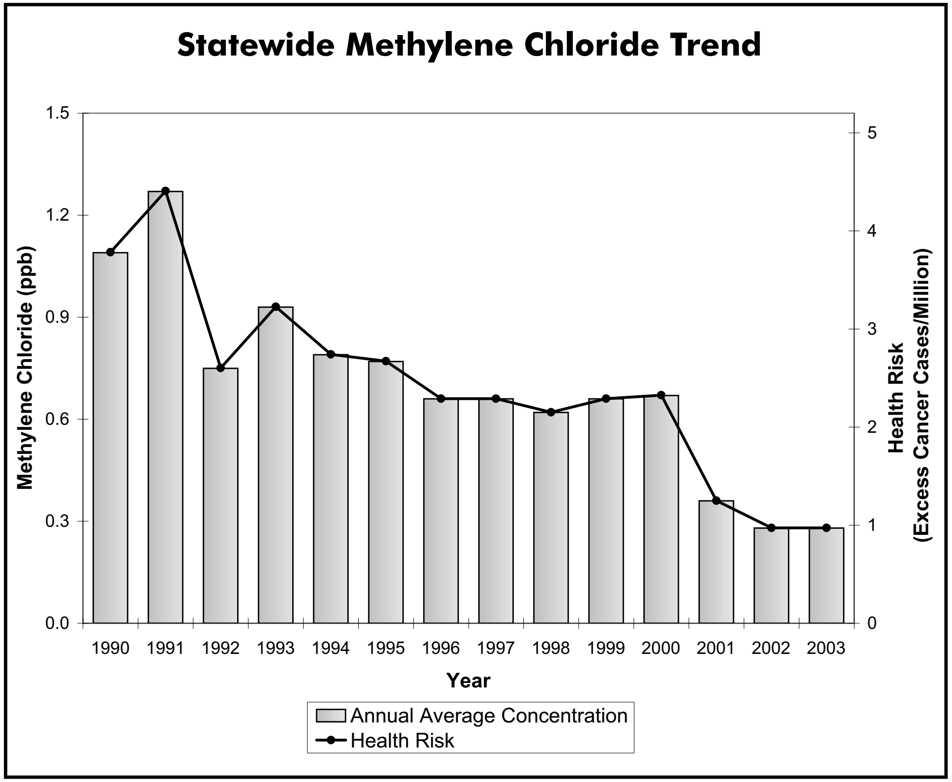

Figure 5-9

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Perchloroethylene

2004 Statewide Emission Inventory

The ARB identified perchloroethylene as a Toxic Air Contaminant in 1991 under California's TAC program (AB 1807). In California, perchloroethylene has been identified as a carcinogen. Perchloroethylene vapors are irritating to the eyes and respiratory tract. Following chronic exposure, workers have shown signs of liver toxicity, as well as kidney dysfunction and neurological effects.

Perchloroethylene is used as a solvent, primarily in dry cleaning operations. Perchloroethylene is also used in degreasing operations, paints and coatings, adhesives, aerosols, specialty chemical production, printing inks, silicones, rug shampoos, and laboratory solvents. In California, the stationary sources that have reported emissions of perchloroethylene are dry cleaning plants, aircraft part and equipment manufacturers, and fabricated metal product manufacturers. These stationary sources account for 68 percent of the statewide emissions of perchloroethylene. Area-wide sources contribute approximately 32 percent. The primary area-wide sources include consumer products such as automotive brake cleaners and tire sealants and inflators.

Perchloroethylene		
Emissions Source	**tons/year**	**Percent State**
Stationary Sources	4217	68%
Area-wide Sources	2028	32%
On-Road Mobile	0	0%
Gasoline Vehicles	0	0%
Diesel Vehicles	0	0%
Other Mobile	0	0%
Gasoline Fuel	0	0%
Diesel Fuel	0	0%
Other Fuel	0	0%
Natural Sources	0	0%
Total Statewide	***6244***	***100%***

Table 5-18

2004 Top Ten Counties - Perchloroethylene

The top ten counties account for approximately 71 percent of the statewide perchloroethylene emissions. The South Coast Air Basin has four of the top ten counties emitting perchloroethylene: South Coast portion of Los Angeles County (29 percent of the emissions of perchloroethylene statewide), Orange County (nine percent), South Coast portion of San Bernardino County (four percent), and South Coast portion of Riverside County (three percent). Collectively, approximately 45 percent of statewide perchloroethylene emissions occur in the South Coast Air Basin. San Diego County contributes approximately 10 percent. The five other counties in the top ten for perchloroethylene emissions are: Sacramento, Santa Clara, Alameda, Fresno, and San Joaquin. These five counties account for approximately 16 percent of statewide perchloroethylene emissions.

Perchloroethylene			
County	Air Basin	tons/year	Percent
Los Angeles	South Coast	1819	29%
San Diego	San Diego	638	10%
Orange	South Coast	566	9%
Sacramento	Sacramento Valley	255	4%
San Bernardino	South Coast	243	4%
Santa Clara	San Francisco Bay Area	226	4%
Alameda	San Francisco Bay Area	199	3%
Riverside	South Coast	183	3%
Fresno	San Joaquin Valley	179	3%
San Joaquin	San Joaquin Valley	117	2%

Table 5-19

Perchloroethylene

Air Quality and Health Risk

The ARB routinely monitors perchloroethylene concentrations in the ambient air. Although the trend graph for perchloroethylene shows some variability, there is an overall downward trend. To examine the trend in perchloroethylene while minimizing the influences of weather on the trend, the statewide average perchloroethylene concentration for 1990-1992 was compared to that for 2001-2003. The result is a 71 percent decrease in both concentration and health risk. Figure 5-10 shows annual average statewide perchloroethylene concentrations and the associated health risk for 1990 through 2003. No data are shown for 1999 because complete and representative data are not available. During 2003, there was an estimated risk of two excess cancer cases per million people. Based on this, perchloroethylene ranks ninth out of the ten compounds presented in this almanac. Health risk is based on the annual average concentration and represents the estimated risk of excess cancer cases per million people exposed over a 70-year lifetime at the specified concentration level.

When the ARB identified perchloroethylene as a TAC in October 1991, the ARB estimated that 60 percent of perchloroethylene came from dry cleaning operations. Examination of industry practices suggested the potential for significant reductions of emissions. The ARB focused control efforts on that industry and adopted a control measure governing the use of perchloroethylene in dry cleaning operations in October, 1993. The final deadline for compliance was 1998. In addition to requiring emission controls, the ARB has worked with industry to provide training for industry personnel on improved practices and methods for reducing emissions. In the near future, the most significant factor affecting emissions will most likely be a continued reduction as more dry cleaning operations modify or replace older equipment. In the long-term, increasing population in California may lead to increased demand for services and products using perchloroethylene, which may increase emissions from dry cleaners. However, the ARB has developed control measures that prohibit the use of perchloroethene in automotive products, aerosol adhesives, and aerosol coatings.

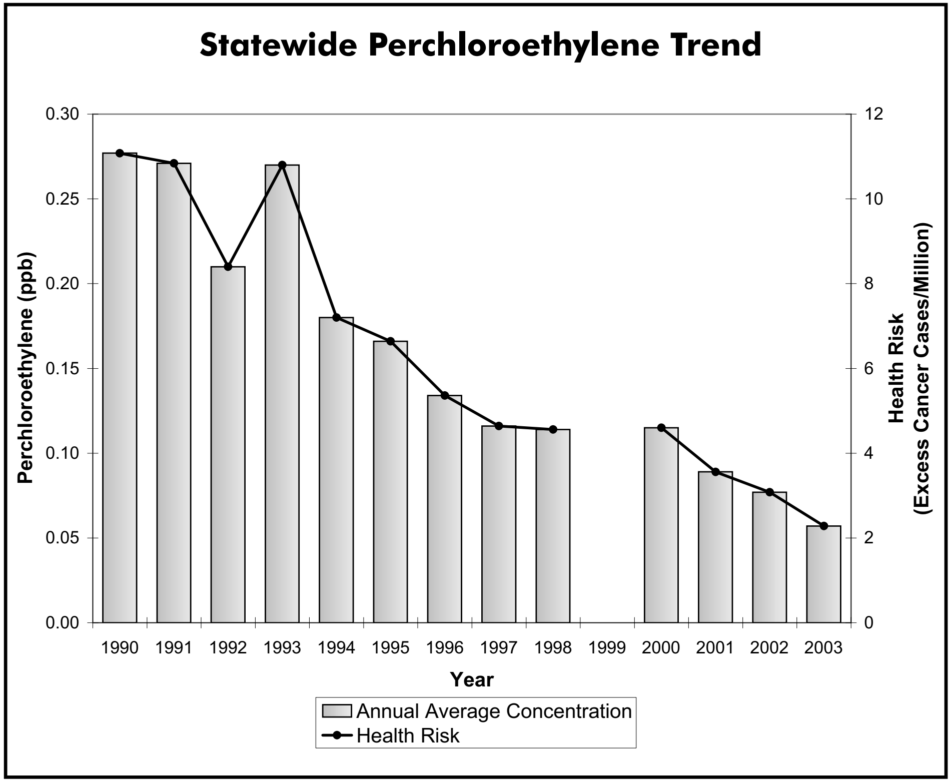

Figure 5-10

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Diesel Particulate Matter

2004 Statewide Emission Inventory

The ARB identified the particulate matter (PM) emissions from diesel-fueled engines as a TAC in August 1998 under California's TAC program. In California, diesel engine exhaust has been identified as a carcinogen. Most researchers believe that diesel exhaust particles contribute the majority of the risk.

Diesel PM is emitted from both mobile and stationary sources. In California, on-road diesel-fueled vehicles contribute approximately 24 percent of the statewide total, with an additional 71 percent attributed to other mobile sources such as construction and mining equipment, agricultural equipment, and transport refrigeration units. Stationary sources, contributing about five percent of emissions, include shipyards, warehouses, heavy equipment repair yards, and oil and gas production operations. Emissions from these sources are from diesel-fueled internal combustion engines. Stationary sources that report diesel PM emissions also include heavy construction (except highway), manufacturers of asphalt paving materials and blocks, and electrical generation.

Readers may note that the stationary source diesel PM emission estimates differ from those presented in previous editions of the almanac and in the ARB's October 2000 report entitled: *"Risk Reduction Plan to Reduce Particulate Matter Emissions from Diesel-Fueled Engines and Vehicles"* (Diesel Risk Reduction Plan). This is because they incorporate more recent data and have been calculated with updated methodologies developed for new regulations. These regulations are those that were recommended in the Diesel Risk Reduction Plan. The on-road mobile source emissions cited in the Diesel Risk Reduction Plan are based on an earlier version of EMFAC 2001 (EMFAC 1.99(f) 6/26/00) and the other mobile inventory includes revised estimates for ship diesel PM emissions.

Diesel PM		
Emissions Source	**tons/year**	**Percent State**
Stationary Sources	1299	5%
Area-wide Sources	0	0%
On-Road Mobile	5917	24%
Gasoline Vehicles	0	0%
Diesel Vehicles	5917	24%
Other Mobile	17282	71%
Gasoline Fuel	0	0%
Diesel Fuel	17282	71%
Other Fuel	0	0%
Natural Sources	0	0%
Total Statewide	***24497***	***100%***

Table 5-20

2004 Top Ten Counties - Diesel Particulate Matter

The top ten counties account for approximately 56 percent of the statewide diesel particulate matter emissions. The South Coast Air Basin has four of the top ten counties emitting diesel particulate matter: South Coast portion of Los Angeles County (18 percent of the emissions of diesel particulate matter statewide), Orange County (seven percent), South Coast portion of Riverside County (four percent), and the South Coast portion of San Bernardino County (three percent). Collectively, approximately 32 percent of statewide diesel particulate matter emissions occur in the South Coast Air Basin. San Diego County contributes approximately six percent, and Fresno County contributes approximately four percent. Three counties in the San Francisco Bay Area Air Basin contribute 11 percent: Alameda (four percent), Santa Clara (four percent), and San Francisco (three percent).

Diesel PM			
County	Air Basin	tons/year	Percent
Los Angeles	South Coast	4490	18%
Orange	South Coast	1670	7%
San Diego	San Diego	1527	6%
Fresno	San Joaquin Valley	1006	4%
Riverside	South Coast	996	4%
Alameda	San Francisco Bay Area	914	4%
Santa Clara	San Francisco Bay Area	904	4%
San Bernardino	South Coast	795	3%
San Francisco	San Francisco Bay Area	764	3%
Kern	San Joaquin Valley	749	3%

Table 5-21

Diesel Particulate Matter

Air Quality and Health Risk

The exhaust from diesel-fueled engines is a complex mixture of gases, vapors, and particles, many of which are known human carcinogens. More than 40 diesel exhaust components are listed by the State and federal governments as toxic air contaminants or hazardous air pollutants. Most researchers believe that diesel PM contributes the majority of the risk from exposure to diesel exhaust because the particles carry many of the harmful organics and metals present in the exhaust.

Unlike the other toxic air contaminants presented in this almanac, the ARB does not monitor diesel PM because there is no routine method for monitoring ambient concentrations. However, the ARB made a preliminary estimation of diesel PM concentrations for the State's 15 air basins and for the State as a whole using a PM-based exposure method. The method uses the ARB emission inventory's PM_{10} database, ambient PM_{10} monitoring data, and the results from several studies with chemical speciation of ambient data. These data were used, along with receptor modeling techniques, to estimate statewide outdoor concentrations of diesel PM. The ARB subsequently updated the original statewide estimates based on the ratio between the previous estimate for 1990 and the most recent diesel PM emission inventory for the year 1990. The details of the methodology are described in Appendix VI to the ARB report entitled: *"Risk Reduction Plan to Reduce Particulate Matter Emissions from Diesel-Fueled Engines and Vehicles,"* (Risk Reduction Plan or Plan) dated October, 2000.

The updated statewide population-weighted average diesel PM concentrations and health risk for various years are shown in Figure 5-11. The average statewide concentration for 1990 was estimated at 3.0 micrograms per cubic meter ($\mu g/m^3$). This is associated with a health risk of 900 excess cancer cases per million people exposed over a 70-year lifetime. The estimates for 2000 show a 40 percent drop from 1990, with a concentration of 1.8 $\mu g/m^3$ and an associated health risk of 540 excess cancer cases per million people. In addition, the ARB estimated population-weighted concentrations for 2010 and 2020. Two estimates are given for 2010 and 2020: one reflecting the estimated ambient concentrations without implementing the Risk Reduction Plan and one reflecting the estimated ambient concentra-

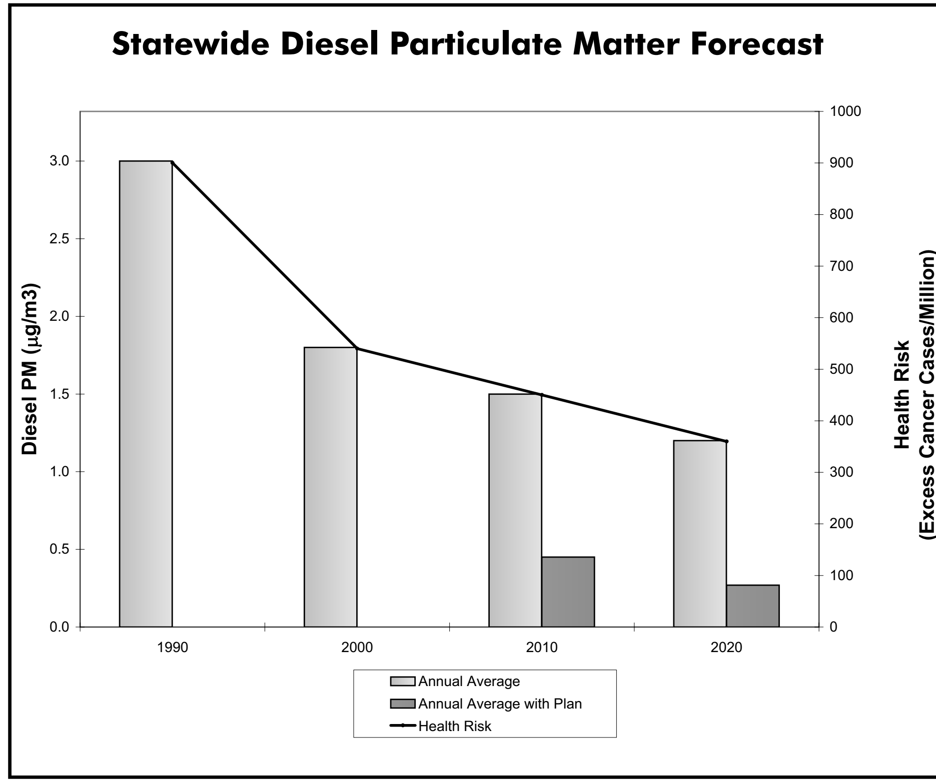


Figure 5-11

tions with implementation of control measures in the Risk Reduction Plan. These future year estimates are based on linear extrapolations from the 1990 emissions inventory and linear rollback techniques. It is important to note that the estimated risk from diesel PM is higher than the risk from all other toxic air contaminants combined, and this TAC poses the most significant risk to California's citizens. In fact, the ARB estimates that 70 percent of the known statewide cancer risk from outdoor air toxics is attributable to diesel PM.

The Risk Reduction Plan provides a mechanism for combating the diesel PM problem. Without implementing the Plan, concentrations in 2010 and 2020 are estimated to drop by only about 17 percent and 33 percent, respectively, from the estimated year 2000 level. However, the goal of the Plan is to reduce concentrations by 75 percent by 2010 and 85 percent by 2020. The key elements of the Plan are to clean up existing engines through engine retrofit emission control devices, to adopt stringent standards for new diesel engines, and to lower the sulfur content of diesel fuel to protect new, and very effective, advanced technology emission control devices on diesel engines. When fully implemented, the Risk Reduction Plan will significantly reduce emissions from both old and new diesel-fueled motor vehicles and from stationary sources that burn diesel fuel. In addition to these strategies, the ARB continues to promote the use of alternative fuels and electrification. As a result of these actions, diesel PM concentrations and associated health risks should continue to decline.

South Coast Air Basin

2004 Emission Inventory by Compound

Acetaldehyde

Approximately 94 percent of the emissions of acetaldehyde are from mobile sources.

South Coast - Acetaldehyde			
Emissions Source	**tons/year**	**Percent Air Basin**	**Percent State**
Stationary Sources	17	1%	0%
Area-wide Sources	86	5%	1%
On-Road Mobile	605	37%	8%
Gasoline Vehicles	270	16%	4%
Diesel Vehicles	335	20%	5%
Other Mobile	938	57%	13%
Gasoline Fuel	238	14%	3%
Diesel Fuel	695	42%	9%
Other Fuel	4	0%	0%
Natural Sources	0	0%	0%
Total	1645	100%	22%
Total Statewide	**7372**		

Table 5-22

Benzene

The primary sources of benzene emissions in the South Coast Air Basin are mobile sources (approximately 87 percent).

South Coast - Benzene			
Emissions Source	**tons/year**	**Percent Air Basin**	**Percent State**
Stationary Sources	508	12%	4%
Area-wide Sources	44	1%	0%
On-Road Mobile	2293	56%	17%
Gasoline Vehicles	2202	53%	17%
Diesel Vehicles	91	2%	1%
Other Mobile	1285	31%	10%
Gasoline Fuel	1092	26%	8%
Diesel Fuel	189	5%	1%
Other Fuel	4	0%	0%
Natural Sources	0	0%	0%
Total	4130	100%	31%
Total Statewide	**13183**		

Table 5-23

1,3-Butadiene

Approximately 93 percent of the emissions of 1,3-butadiene are from mobile sources.

Carbon Tetrachloride

Stationary sources, such as chemical manufacturers and petroleum refineries, account for all of the emissions of carbon tetrachloride.

South Coast - 1,3-Butadiene			
Emissions Source	**tons/year**	**Percent Air Basin**	**Percent State**
Stationary Sources	7	1%	0%
Area-wide Sources	39	5%	1%
On-Road Mobile	470	58%	16%
Gasoline Vehicles	461	57%	15%
Diesel Vehicles	9	1%	0%
Other Mobile	281	35%	9%
Gasoline Fuel	263	32%	9%
Diesel Fuel	18	2%	1%
Other Fuel	< 1	0%	0%
Natural Sources	17	2%	1%
Total	815	100%	27%
Total Statewide	**3030**		

Table 5-24

South Coast - Carbon Tetrachloride			
Emissions Source	**tons/year**	**Percent Air Basin**	**Percent State**
Stationary Sources	0.39	100%	17%
Area-wide Sources	0	0%	0%
On-Road Mobile	0	0%	0%
Gasoline Vehicles	0	0%	0%
Diesel Vehicles	0	0%	0%
Other Mobile	0	0%	0%
Gasoline Fuel	0	0%	0%
Diesel Fuel	0	0%	0%
Other Fuel	0	0%	0%
Natural Sources	0	0%	0%
Total	0.39	100%	17%
Total Statewide	**2.30**		

Table 5-25

Chromium, Hexavalent

Approximately 80 percent of the hexavalent chromium emissions are from stationary sources such as electrical generation, aircraft and parts manufacturing, and fabricated metal product manufacturing.

South Coast - Chromium, Hexavalent			
Emissions Source	**tons/year**	**Percent Air Basin**	**Percent State**
Stationary Sources	0.41	80%	23%
Area-wide Sources	0	0%	0%
On-Road Mobile	0.05	10%	3%
Gasoline Vehicles	0.05	9%	3%
Diesel Vehicles	< .01	0%	0%
Other Mobile	0.05	10%	3%
Gasoline Fuel	0.05	10%	3%
Diesel Fuel	< .01	1%	0%
Other Fuel	0	0%	0%
Natural Sources	0	0%	0%
Total	0.51	100%	29%
Total Statewide	**1.73**		

Table 5-26

para-Dichlorobenzene

Most of the emissions of *para*-dichlorobenzene are from consumer products (non-aerosol insect repellants and solid/gel air fresheners).

South Coast - *para*-DiChlorobenzene			
Emissions Source	**tons/year**	**Percent Air Basin**	**Percent State**
Stationary Sources	9	1%	0%
Area-wide Sources	786	99%	42%
On-Road Mobile	0	0%	0%
Gasoline Vehicles	0	0%	0%
Diesel Vehicles	0	0%	0%
Other Mobile	0	0%	0%
Gasoline Fuel	0	0%	0%
Diesel Fuel	0	0%	0%
Other Fuel	0	0%	0%
Natural Sources	0	0%	0%
Total	795	100%	42%
Total Statewide	**1879**		

Table 5-27

Formaldehyde

Approximately 81 percent of the formaldehyde emissions are from mobile sources.

South Coast - Formaldehyde			
Emissions Source	**tons/year**	**Percent Air Basin**	**Percent State**
Stationary Sources	802	15%	4%
Area-wide Sources	179	3%	1%
On-Road Mobile	1900	36%	9%
Gasoline Vehicles	1230	23%	6%
Diesel Vehicles	670	13%	3%
Other Mobile	2401	45%	12%
Gasoline Fuel	990	19%	5%
Diesel Fuel	1392	26%	7%
Other Fuel	19	0%	0%
Natural Sources	0	0%	0%
Total	5281	100%	26%
Total Statewide	**20251**		

Table 5-28

Methylene Chloride

Approximately 66 percent of the emissions of methylene chloride are from stationary sources such as plastic product manufacturers, manufacturers of synthetics, and aircraft and parts manufacturers.

South Coast - Methylene Chloride			
Emissions Source	**tons/year**	**Percent Air Basin**	**Percent State**
Stationary Sources	2930	66%	38%
Area-wide Sources	1538	34%	20%
On-Road Mobile	0	0%	0%
Gasoline Vehicles	0	0%	0%
Diesel Vehicles	0	0%	0%
Other Mobile	0	0%	0%
Gasoline Fuel	0	0%	0%
Diesel Fuel	0	0%	0%
Other Fuel	0	0%	0%
Natural Sources	0	0%	0%
Total	4468	100%	59%
Total Statewide	**7637**		

Table 5-29

Perchloroethylene

Approximately 70 percent of the emissions of perchloroethylene are from dry cleaning plants, manufacturers of aircraft parts and fabricated metal parts, and other stationary sources.

South Coast - Perchloroethylene			
Emissions Source	**tons/year**	**Percent Air Basin**	**Percent State**
Stationary Sources	1955	70%	31%
Area-wide Sources	856	30%	14%
On-Road Mobile	0	0%	0%
Gasoline Vehicles	0	0%	0%
Diesel Vehicles	0	0%	0%
Other Mobile	0	0%	0%
Gasoline Fuel	0	0%	0%
Diesel Fuel	0	0%	0%
Other Fuel	0	0%	0%
Natural Sources	0	0%	0%
Total	2810	100%	45%
Total Statewide	**6244**		

Table 5-30

Diesel Particulate Matter

Approximately 97 percent of emissions of diesel particulate matter are from mobile sources.

South Coast - Diesel PM			
Emissions Source	**tons/year**	**Percent Air Basin**	**Percent State**
Stationary Sources	222	3%	1%
Area-wide Sources	0	0%	0%
On-Road Mobile	2139	27%	9%
Gasoline Vehicles	0	0%	0%
Diesel Vehicles	2139	27%	9%
Other Mobile	5591	70%	23%
Gasoline Fuel	0	0%	0%
Diesel Fuel	5591	70%	23%
Other Fuel	0	0%	0%
Natural Sources	0	0%	0%
Total	7952	100%	32%
Total Statewide	**24497**		

Table 5-31

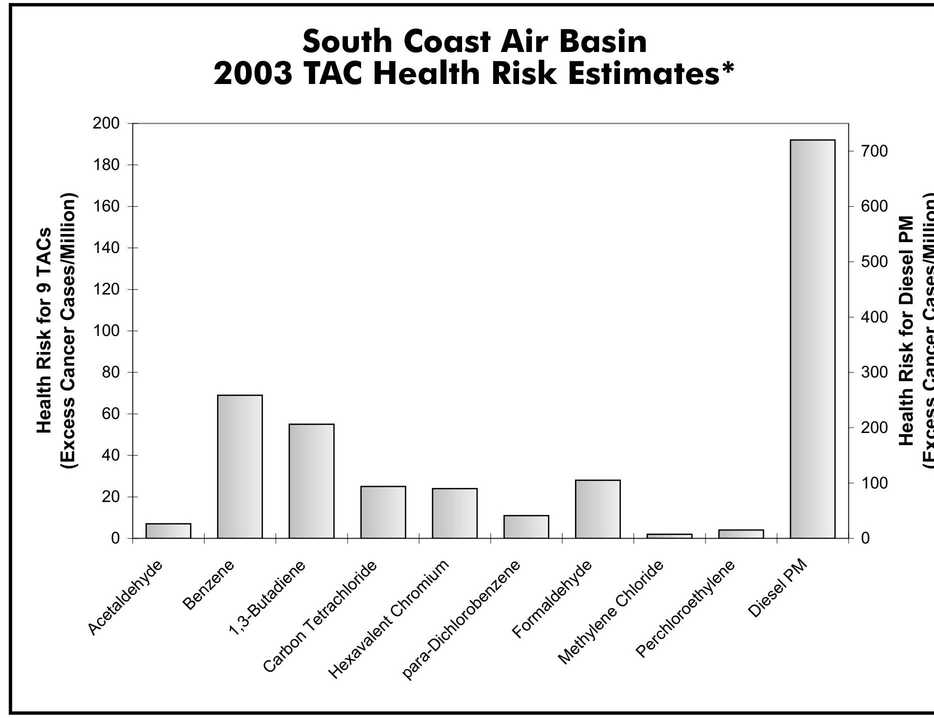
South Coast Air Basin

Air Quality and Health Risk

From 1990 through 2003, the ARB monitored ambient toxics concentrations at seven sites in the South Coast Air Basin. Data are available for most of the years at sites located in Burbank, Los Angeles, North Long Beach, and Riverside. Measurements for 1990 through 1997 are also available from a site at Upland. In addition, there are data for 1998 at a site in Fontana. During December 1999, monitoring activities for most of the TACs at Fontana were relocated to Azusa, and this site is now part of the statewide ambient TAC monitoring network. Annual average concentrations and associated health risks for the top ten TACs individually, as well as their cumulative health risk for the South Coast Air Basin, are shown in Table 5-32. Data for individual sites are listed in Appendix C.

Two special study sites, located in the Boyle Heights and Wilmington areas of Los Angeles, were operated between February 2001 and May 2002 (Boyle Heights) and between May 2001 and July 2002 (Wilmington). Monitoring was conducted for both TACs and criteria air pollutants. Limited monitoring of a few pollutants was conducted at two satellite sites in Boyle Heights from March 2001 through October 2001, and at one satellite site in Wilmington from November 2001 through May 2002. The Boyle Heights and Wilmington communities are both located near major freeways. The Wilmington community is also located near oil refineries and port facilities. Although not included in this almanac, data from Boyle Heights, Wilmington, and other community monitoring studies are being used in support of the ARB's Community Health Program. Copies of the full reports are available at *www.arb.ca.gov/ch/programs/sb25/sb25.htm*.

Figure 5-12 shows 2003 health risks posed by the top ten TACs individually for the South Coast Air Basin. As indicated on the graph, the health risk data reflect the year of 2003, except for diesel PM. Data for this TAC reflect the year 2000, the most recent year for which complete and representative data are available. It is important to note that health risks shown here are based on an annual average concentration for all sites in the air basin. The health risk at individual locations may be higher or lower than the average for the air basin, depending on the impact of nearby sources.



** Data for diesel PM reflect 2000; data for all other TACs reflect 2003.*

Figure 5-12

Of the ten TACs considered in this almanac, diesel PM presents the most substantial health risk. In the South Coast Air Basin, the estimated health risk from diesel PM is 720 excess cancer cases per million people. Although the health risk is higher than the statewide average, it represents a 33 percent drop between 1990 and 2000. Although much smaller by comparison, 1,3-butadiene and benzene also pose substantial health risks. Since 1990, their health risks have been reduced by 59 percent and 73 percent, respectively. Perchloroethylene and methylene chloride also show substantial reductions of 72 percent and 58 percent, respectively. Overall, in South Coast Air Basin, all TACs except formaldehyde have been reduced since 1990, but their health risks are still higher than the statewide levels.

It is important to note that there may be other compounds that pose a significant risk but are not monitored. Reductions in ambient TAC concentrations and health risks should continue, as new rules and regulations are implemented to control toxic air contaminants.

South Coast Air Basin

Annual Average Concentrations and Health Risks

South Coast Air Basin Toxic Air Contaminants-Annual Average Concentrations and Health Risks															
TAC*	**Conc./Risk**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**
Acetaldehyde	Annual Avg	2.46	3.00	2.46	2.67	2.30	0.97	2.08	1.77	1.54	1.63	1.26	1.47	1.41	1.47
	Health Risk	12	15	12	13	11	5	10	9	7	8	6	7	7	7
Benzene	Annual Avg	3.42	2.91	2.61	2.17	2.40	1.89	1.45	1.34	1.25	1.20	0.97	0.86	0.77	0.75
	Health Risk	317	269	242	201	222	175	134	124	116	111	90	80	71	69
1,3-Butadiene	Annual Avg	0.53	0.45	0.50	0.57	0.50	0.46	0.39	0.38	0.35	0.33	0.25	0.25	0.21	0.15
	Health Risk	200	170	187	212	187	173	146	142	133	123	94	94	79	55
Carbon Tetrachloride	Annual Avg	0.14	0.13		0.11		0.10	0.08		0.11		0.10	0.09	0.09	0.09
	Health Risk	36	35		28		27	21		30		25	23	24	25
Chromium, Hexavalent	Annual Avg			0.39	0.29	0.29	0.46	0.18	0.17	0.15	0.14	0.18		0.18	0.16
	Health Risk			59	43	43	69	27	25	22	22	27		27	24
para-Dichlorobenzene	Annual Avg		0.17	0.19	0.17	0.13	0.17	0.11	0.13			0.13	0.15	0.16	0.17
	Health Risk		11	13	11	8	11	7	9			9	10	11	11
Formaldehyde	Annual Avg	2.92	3.08	2.22	3.22	3.14	3.57	5.06	4.47	3.79	4.06	3.13	4.13	4.16	3.83
	Health Risk	22	23	16	24	23	26	37	33	28	30	23	30	31	28
Methylene Chloride	Annual Avg	1.86	1.51	0.90	1.23	1.10	1.28	0.95	1.14	0.85	0.92	0.83	0.63	0.57	0.59
	Health Risk	6	5	3	4	4	4	3	4	3	3	3	2	2	2
Perchloroethylene	Annual Avg	0.58	0.55	0.41	0.45	0.39	0.36	0.32	0.27	0.26		0.21	0.18	0.15	0.11
	Health Risk	23	22	16	18	16	15	13	11	10		8	7	6	4
*Diesel Particulate Matter***	*Annual Avg*	*(3.6)*					*(2.7)*					*(2.4)*			
	Health Risk	*(1080)*					*(810)*					*(720)*			
Average Basin Risk***	Without Diesel PM	616	550	548	554	514	505	398	357	349	297	285	253	258	225
	With Diesel PM	*(1696)*					*(1315)*					*(1005)*			

* Concentrations for Hexavalent Chromium are expressed as ng/m3 and concentrations for diesel PM are expressed as ug/m3. Concentrations for all other TACs are expressed as parts per billion.

** Diesel PM concentration estimates are based on receptor modeling techniques, and estimates are available only for selected years.

*** Health Risk represents the number of excess cancer cases per million people based on a lifetime (70-year) exposure to the annual average concentration. It reflects only those compounds listed in this table and only those with data for that year. There may be other significant compounds for which we do not monitor or have health risk information. Additional information about interpreting the toxic air contaminant air quality trends can be found in Chapter 1, *Interpreting the Emission and Air Quality Statistics.*

Table 5-32

San Francisco Bay Area Air Basin

2004 Emission Inventory by Compound

Acetaldehyde

Approximately 75 percent of the emissions of acetaldehyde are from mobile sources. Area-wide sources such as residential wood combustion and agricultural burning contribute approximately 21 percent.

San Francisco Bay Area - Acetaldehyde			
Emissions Source	**tons/year**	**Percent Air Basin**	**Percent State**
Stationary Sources	54	4%	1%
Area-wide Sources	275	21%	4%
On-Road Mobile	332	25%	5%
Gasoline Vehicles	151	11%	2%
Diesel Vehicles	181	14%	2%
Other Mobile	660	50%	9%
Gasoline Fuel	103	8%	1%
Diesel Fuel	406	31%	6%
Other Fuel	150	11%	2%
Natural Sources	0	0%	0%
Total	1321	100%	18%
Total Statewide	**7372**		

Table 5-33

Benzene

Mobile sources are the primary sources of benzene emissions in the San Francisco Bay Area Air Basin (approximately 90 percent).

San Francisco Bay Area - Benzene			
Emissions Source	**tons/year**	**Percent Air Basin**	**Percent State**
Stationary Sources	160	8%	1%
Area-wide Sources	34	2%	0%
On-Road Mobile	1292	60%	10%
Gasoline Vehicles	1243	58%	9%
Diesel Vehicles	49	2%	0%
Other Mobile	650	30%	5%
Gasoline Fuel	476	22%	4%
Diesel Fuel	111	5%	1%
Other Fuel	63	3%	0%
Natural Sources	0	0%	0%
Total	2136	100%	16%
Total Statewide	**13183**		

Table 5-34

1,3-Butadiene

Essentially all of the emissions of 1,3-butadiene are from mobile sources.

San Francisco Bay Area - 1,3-Butadiene			
Emissions Source	**tons/year**	**Percent Air Basin**	**Percent State**
Stationary Sources	6	1%	0%
Area-wide Sources	2	0%	0%
On-Road Mobile	270	59%	9%
Gasoline Vehicles	265	57%	9%
Diesel Vehicles	5	1%	0%
Other Mobile	182	39%	6%
Gasoline Fuel	114	25%	4%
Diesel Fuel	11	2%	0%
Other Fuel	57	12%	2%
Natural Sources	1	0%	0%
Total	461	100%	15%
Total Statewide	**3030**		

Table 5-35

Carbon Tetrachloride

Stationary sources, such as chemical and petroleum refineries, account for all of the emissions of carbon tetrachloride.

San Francisco Bay Area - Carbon Tetrachloride			
Emissions Source	**tons/year**	**Percent Air Basin**	**Percent State**
Stationary Sources	1.53	100%	65%
Area-wide Sources	0	0%	0%
On-Road Mobile	0	0%	0%
Gasoline Vehicles	0	0%	0%
Diesel Vehicles	0	0%	0%
Other Mobile	0	0%	0%
Gasoline Fuel	0	0%	0%
Diesel Fuel	0	0%	0%
Other Fuel	0	0%	0%
Natural Sources	0	0%	0%
Total	1.53	100%	65%
Total Statewide	**2.30**		

Table 5-36

Chromium, Hexavalent

Approximately 75 percent of the hexavalent chromium emissions are from other mobile sources. Stationary sources such as electrical generation and fabricated metal product manufacturing contribute approximately four percent.

San Francisco Bay Area - Chromium, Hexavalent			
Emissions Source	**tons/year**	**Percent Air Basin**	**Percent State**
Stationary Sources	< .01	4%	0%
Area-wide Sources	0	0%	0%
On-Road Mobile	0.02	22%	1%
Gasoline Vehicles	0.02	21%	1%
Diesel Vehicles	< .01	0%	0%
Other Mobile	0.08	75%	5%
Gasoline Fuel	0.02	19%	1%
Diesel Fuel	< .01	1%	0%
Other Fuel	0.06	54%	3%
Natural Sources	0	0%	0%
Total	0.11	100%	6%
Total Statewide	**1.73**		

Table 5-37

para-Dichlorobenzene

Emissions of *para*-dichlorobenzene are essentially all from consumer products (non-aerosol insect repellants and solid/gel air fresheners).

San Francisco Bay Area - *para*-DiChlorobenzene			
Emissions Source	**tons/year**	**Percent Air Basin**	**Percent State**
Stationary Sources	< 1	0%	0%
Area-wide Sources	359	100%	19%
On-Road Mobile	0	0%	0%
Gasoline Vehicles	0	0%	0%
Diesel Vehicles	0	0%	0%
Other Mobile	0	0%	0%
Gasoline Fuel	0	0%	0%
Diesel Fuel	0	0%	0%
Other Fuel	0	0%	0%
Natural Sources	0	0%	0%
Total	360	100%	19%
Total Statewide	**1879**		

Table 5-38

Formaldehyde

Approximately 84 percent of the formaldehyde emissions are from mobile sources.

San Francisco Bay Area - Formaldehyde			
Emissions Source	**tons/year**	**Percent Air Basin**	**Percent State**
Stationary Sources	175	5%	1%
Area-wide Sources	360	11%	2%
On-Road Mobile	1050	32%	5%
Gasoline Vehicles	688	21%	3%
Diesel Vehicles	362	11%	2%
Other Mobile	1728	52%	9%
Gasoline Fuel	425	13%	2%
Diesel Fuel	813	25%	4%
Other Fuel	490	15%	2%
Natural Sources	0	0%	0%
Total	3313	100%	16%
Total Statewide	**20251**		

Table 5-39

Methylene Chloride

Approximately 63 percent of the emissions of methylene chloride are from area-wide sources.

San Francisco Bay Area - Methylene Chloride			
Emissions Source	**tons/year**	**Percent Air Basin**	**Percent State**
Stationary Sources	419	37%	5%
Area-wide Sources	705	63%	9%
On-Road Mobile	0	0%	0%
Gasoline Vehicles	0	0%	0%
Diesel Vehicles	0	0%	0%
Other Mobile	0	0%	0%
Gasoline Fuel	0	0%	0%
Diesel Fuel	0	0%	0%
Other Fuel	0	0%	0%
Natural Sources	0	0%	0%
Total	1124	100%	15%
Total Statewide	**7637**		

Table 5-40

Perchloroethylene

Approximately 56 percent of the emissions of perchloroethylene are from such stationary sources as dry cleaning plants and manufacturers of aircraft parts and fabricated metal parts.

San Francisco Bay Area - Perchloroethylene			
Emissions Source	**tons/year**	**Percent Air Basin**	**Percent State**
Stationary Sources	499	56%	8%
Area-wide Sources	390	44%	6%
On-Road Mobile	0	0%	0%
Gasoline Vehicles	0	0%	0%
Diesel Vehicles	0	0%	0%
Other Mobile	0	0%	0%
Gasoline Fuel	0	0%	0%
Diesel Fuel	0	0%	0%
Other Fuel	0	0%	0%
Natural Sources	0	0%	0%
Total	888	100%	14%
Total Statewide	**6244**		

Table 5-41

Diesel Particulate Matter

Emissions of diesel particulate matter are primarily from mobile sources.

San Francisco Bay Area - Diesel PM			
Emissions Source	**tons/year**	**Percent Air Basin**	**Percent State**
Stationary Sources	87	2%	0%
Area-wide Sources	0	0%	0%
On-Road Mobile	1102	25%	4%
Gasoline Vehicles	0	0%	0%
Diesel Vehicles	1102	25%	4%
Other Mobile	3225	73%	13%
Gasoline Fuel	0	0%	0%
Diesel Fuel	3225	73%	13%
Other Fuel	0	0%	0%
Natural Sources	0	0%	0%
Total	4414	100%	18%
Total Statewide	**24497**		

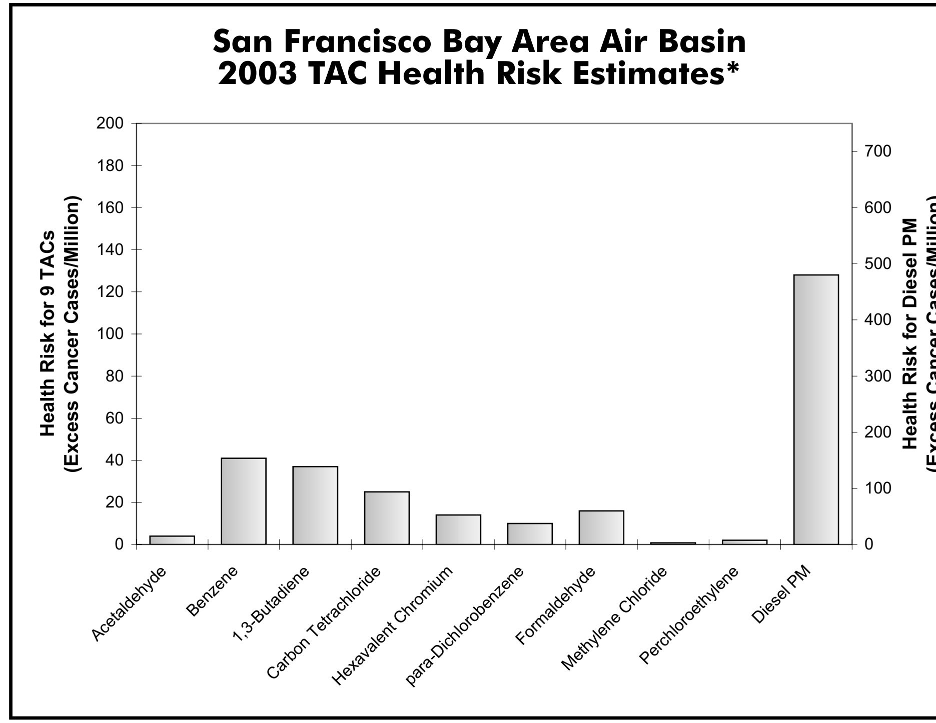
Table 5-42

San Francisco Bay Area Air Basin

Air Quality and Health Risk

From 1990 through 2003, the ARB monitored ambient TAC concentrations at six sites in the San Francisco Bay Area Air Basin. Data for the entire time period are available from sites located in Fremont and San Francisco. San Jose-Fourth Street site has measurements from 1990 through 2001; this site was relocated to San Jose-Jackson Street in mid-2002. Data are also available from a site at Concord from 1990 through 1999. In addition, there was a monitor at Richmond from 1990 through April 1997. This site was relocated to San Pablo and began sampling there in May 1997. At the end of February 2000, TAC monitoring was discontinued at the Concord and San Pablo sites, and additional data from these sites will not be available. Annual average concentration and associated health risk are unavailable for the year during the site move because neither site has a full year of data. Annual average concentrations and health risks for the top ten TACs individually, as well as their cumulative health risk for the San Francisco Bay Area Air Basin, are shown in Table 5-43. Data for individual sites are shown in Appendix C.

Two special study sites, located in the Crockett and Fruitvale/Oakland areas of the San Francisco Bay Area Air Basin, were operated between October 2001 and May 2003 (Crockett) and between November 2001 and April 2003 (Fruitvale). Monitoring was conducted for both TACs and criteria air pollutants. The Crockett community is located near high-risk facilities, including mobile source emissions. Oil refineries and major oil storage facilities are located in nearby cities to Crockett. Crockett is also the location of a major food processing operation and a heavy-rail transfer facility. The Fruitvale community lies between two major freeways that are a significant source of vehicular emissions. The Fruitvale area is also downwind of several industrial operations that are sources of pollution. Although not included in this almanac, data from Crockett, Fruitvale, and other community monitoring studies are being used in support of the ARB's Community Health Program. Copies of the full reports are available at *www.arb.ca.gov/ch/programs/sb25/sb25.htm*.



** Data for diesel PM reflect 2000; data for all other TACs reflect 2003.*

Figure 5-13

Figure 5-13 shows 2003 health risks for the top ten TACs individually for the San Francisco Bay Area Air Basin. As indicated on the graph, the health risk data reflect the year 2003 except for diesel PM. Data for this TAC reflect the year 2000, the most recent year for which complete and representative data are available. It is important to note that health risks shown here are based on an annual average concentration for all sites in the air basin. The health risk at individual locations may be higher or lower than the average for the air basin, depending on the impact of nearby sources.

Of the ten TACs considered in this almanac, diesel PM poses the greatest health risk in this air basin, 480 excess cancer cases per million people exposed for 70 years. The estimate is slightly lower than the estimated statewide value for the same year, and it represents a 36 percent drop between 1990 and 2000. Aside from diesel PM, 1,3-butadiene and benzene also pose substantial health risks. Since 1990, they have been reduced by 60 percent and 76 percent, respectively. Methylene chloride and perchloroethylene also show significant reductions of 82 percent and 75 percent, respectively. Overall, in the San Francisco Bay Area Air Basin, all TACs except for *para*-dichlorobenzene and formaldehyde show a reduction since 1990.

In general, the average concentrations and associated health risks of the top ten TACs for the San Francisco Bay Area Air Basin are lower than the statewide averages, and they are much lower than those for the South Coast Air Basin. However, it is important to note that there may be other compounds that pose a significant risk but are not monitored. Reductions in ambient level of TACs should continue as additional control measures are implemented.

San Francisco Bay Area Air Basin

Annual Average Concentrations and Health Risks

San Francisco Bay Area Air Basin Toxic Air Contaminants-Annual Average Concentrations and Health Risks															
TAC*	**Conc./Risk**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**
Acetaldehyde	Annual Avg	1.30	1.40	1.03	1.31	1.17	0.42	0.83	0.73	0.65	0.76	0.68	0.73	0.63	0.74
	Health Risk	6	7	5	6	6	2	4	4	3	4	3	4	3	4
Benzene	Annual Avg	2.18	1.82	1.49	1.49	1.40	1.26	0.71	0.61	0.71	0.60	0.56	0.43	0.45	0.44
	Health Risk	202	169	138	138	129	116	66	56	66	55	52	39	42	41
1,3-Butadiene	Annual Avg	0.36	0.29	0.28	0.37	0.29	0.28	0.22	0.19	0.22	0.17	0.15	0.13	0.14	0.10
	Health Risk	135	108	103	138	108	104	82	70	82	64	56	50	51	37
Carbon Tetrachloride	Annual Avg	0.13	0.13		0.11		0.10	0.08				0.09	0.09	0.09	0.10
	Health Risk	34	33		29		26	21				25	23	24	25
Chromium, Hexavalent	Annual Avg			0.23	0.20	0.19	0.25	0.13	0.12	0.10	0.10	0.12		0.07	0.10
	Health Risk			34	29	29	37	19	17	15	15	18		11	14
para-Dichlorobenzene	Annual Avg		0.12	0.12	0.12	0.11	0.13	0.14	0.12			0.11	0.14	0.15	0.15
	Health Risk		8	8	8	7	8	9	8			7	9	10	10
Formaldehyde	Annual Avg	1.87	1.73	1.43	1.56	1.66	2.06	2.62	1.85	1.76	2.09	1.77	2.32	2.57	2.22
	Health Risk	14	13	11	11	12	15	19	14	13	15	13	17	19	16
Methylene Chloride	Annual Avg	1.04	2.32	0.65	0.72	0.59	0.60	0.58	0.55			0.53	0.27	0.22	0.22
	Health Risk	4	8	2	2	2	2	2	2			2	1	1	1
Perchloroethylene	Annual Avg	0.20	0.23	0.17	0.13	0.08	0.09	0.07	0.07			0.08	0.06	0.05	0.04
	Health Risk	8	9	7	5	3	4	3	3			3	2	2	2
*Diesel Particulate Matter***	*Annual Avg*	*(2.5)*					*(1.9)*					*(1.6)*			
	Health Risk	*(750)*					*(570)*					*(480)*			
Average Basin Risk***	Without Diesel PM	403	355	308	366	296	314	225	174	179	153	179	145	163	150
	With Diesel PM	*(1153)*					*(884)*					*(659)*			

* Concentrations for Hexavalent chromium are expressed as ng/m3 and concentrations for diesel PM are expressed as ug/m3. Concentrations for all other TACs are expressed as parts per billion.

** Diesel PM concentration estimates are based on receptor modeling techniques, and estimates are available only for selected years.

*** Health Risk represents the number of excess cancer cases per million people based on a lifetime (70-year) exposure to the annual average concentration. It reflects only those compounds listed in this table and only those with data for that year. There may be other significant compounds for which we do not monitor or have health risk information. Additional information about interpreting the toxic air contaminant air quality trends can be found in Chapter 1, *Interpreting the Emission and Air Quality Statistics.*

Table 5-43

San Joaquin Valley Air Basin

2004 Emission Inventory by Compound

Acetaldehyde

Approximately 76 percent of the emissions of acetaldehyde are from mobile sources. Area-wide sources such as residential wood combustion account for approximately 17 percent.

San Joaquin Valley - Acetaldehyde			
Emissions Source	**tons/year**	**Percent Air Basin**	**Percent State**
Stationary Sources	72	6%	1%
Area-wide Sources	195	17%	3%
On-Road Mobile	255	22%	3%
Gasoline Vehicles	87	8%	1%
Diesel Vehicles	168	15%	2%
Other Mobile	617	54%	8%
Gasoline Fuel	71	6%	1%
Diesel Fuel	390	34%	5%
Other Fuel	156	14%	3%
Natural Sources	0	0%	0%
Total	1139	100%	15%
Total Statewide	**7372**		

Table 5-44

Benzene

The primary sources of benzene emissions in the San Joaquin Valley Air Basin are mobile sources (approximately 64 percent) and stationary sources (approximately 35 percent).

San Joaquin Valley - Benzene			
Emissions Source	**tons/year**	**Percent Air Basin**	**Percent State**
Stationary Sources	656	35%	5%
Area-wide Sources	13	1%	0%
On-Road Mobile	728	38%	6%
Gasoline Vehicles	683	36%	5%
Diesel Vehicles	46	2%	0%
Other Mobile	500	26%	4%
Gasoline Fuel	329	17%	2%
Diesel Fuel	106	6%	1%
Other Fuel	65	3%	0%
Natural Sources	< 1	0%	0%
Total	1899	100%	14%
Total Statewide	**13183**		

Table 5-45

1,3-Butadiene

Approximately 67 percent of the emissions of 1,3-butadiene are from mobile sources.

San Joaquin Valley - 1,3-Butadiene			
Emissions Source	**tons/year**	**Percent Air Basin**	**Percent State**
Stationary Sources	3	1%	0%
Area-wide Sources	134	30%	4%
On-Road Mobile	150	34%	5%
Gasoline Vehicles	146	33%	5%
Diesel Vehicles	4	1%	0%
Other Mobile	148	33%	5%
Gasoline Fuel	79	18%	3%
Diesel Fuel	10	2%	0%
Other Fuel	59	13%	2%
Natural Sources	10	2%	0%
Total	446	100%	15%
Total Statewide	**3030**		

Table 5-46

Carbon Tetrachloride

Emissions of carbon tetrachloride are all from stationary sources such as chemical and allied product manufacturers.

San Joaquin Valley - Carbon Tetrachloride			
Emissions Source	**tons/year**	**Percent Air Basin**	**Percent State**
Stationary Sources	< .01	100%	0%
Area-wide Sources	0	0%	0%
On-Road Mobile	0	0%	0%
Gasoline Vehicles	0	0%	0%
Diesel Vehicles	0	0%	0%
Other Mobile	0	0%	0%
Gasoline Fuel	0	0%	0%
Diesel Fuel	0	0%	0%
Other Fuel	0	0%	0%
Natural Sources	0	0%	0%
Total	< .01	100%	0%
Total Statewide	**2.30**		

Table 5-47

Chromium, Hexavalent

Approximately 65 percent of the hexavalent chromium emissions are from stationary sources such as electrical generation, aircraft and parts manufacturing, and fabricated metal product manufacturing.

San Joaquin Valley - Chromium, Hexavalent			
Emissions Source	**tons/year**	**Percent Air Basin**	**Percent State**
Stationary Sources	0.13	65%	7%
Area-wide Sources	0	0%	0%
On-Road Mobile	0.01	7%	1%
Gasoline Vehicles	0.01	7%	1%
Diesel Vehicles	< .01	0%	0%
Other Mobile	0.05	28%	3%
Gasoline Fuel	0.01	6%	1%
Diesel Fuel	< .01	1%	0%
Other Fuel	0.04	21%	2%
Natural Sources	0	0%	0%
Total	0.20	100%	11%
Total Statewide	**1.73**		

Table 5-48

para-Dichlorobenzene

Most of the emissions of *para*-dichlorobenzene are from consumer products (non-aerosol insect repellants and solid/gel air fresheners).

San Joaquin Valley - *para*-DiChlorobenzene			
Emissions Source	**tons/year**	**Percent Air Basin**	**Percent State**
Stationary Sources	5	2%	0%
Area-wide Sources	184	98%	10%
On-Road Mobile	0	0%	0%
Gasoline Vehicles	0	0%	0%
Diesel Vehicles	0	0%	0%
Other Mobile	0	0%	0%
Gasoline Fuel	0	0%	0%
Diesel Fuel	0	0%	0%
Other Fuel	0	0%	0%
Natural Sources	0	0%	0%
Total	189	100%	10%
Total Statewide	**1879**		

Table 5-49

Formaldehyde

Approximately 68 percent of the formaldehyde emissions are from mobile sources.

San Joaquin Valley - Formaldehyde			
Emissions Source	**tons/year**	**Percent Air Basin**	**Percent State**
Stationary Sources	984	28%	5%
Area-wide Sources	229	6%	1%
On-Road Mobile	732	21%	4%
Gasoline Vehicles	396	11%	2%
Diesel Vehicles	335	10%	2%
Other Mobile	1574	45%	9%
Gasoline Fuel	289	8%	1%
Diesel Fuel	781	22%	4%
Other Fuel	504	14%	4%
Natural Sources	0	0%	0%
Total	3519	100%	19%
Total Statewide	**20251**		

Table 5-50

Methylene Chloride

Approximately 82 percent of the emissions of methylene chloride are from paint removers/strippers, automotive brake cleaners, and other consumer products.

San Joaquin Valley - Methylene Chloride			
Emissions Source	**tons/year**	**Percent Air Basin**	**Percent State**
Stationary Sources	79	18%	1%
Area-wide Sources	358	82%	5%
On-Road Mobile	0	0%	0%
Gasoline Vehicles	0	0%	0%
Diesel Vehicles	0	0%	0%
Other Mobile	0	0%	0%
Gasoline Fuel	0	0%	0%
Diesel Fuel	0	0%	0%
Other Fuel	0	0%	0%
Natural Sources	0	0%	0%
Total	437	100%	6%
Total Statewide	**7637**		

Table 5-51

Perchloroethylene

Approximately 68 percent of the emissions of perchloroethylene are from such stationary sources as dry cleaning plants and manufacturers of aircraft parts and fabricated metal parts.

San Joaquin Valley - Perchloroethylene			
Emissions Source	**tons/year**	**Percent Air Basin**	**Percent State**
Stationary Sources	434	68%	7%
Area-wide Sources	200	32%	3%
On-Road Mobile	0	0%	0%
Gasoline Vehicles	0	0%	0%
Diesel Vehicles	0	0%	0%
Other Mobile	0	0%	0%
Gasoline Fuel	0	0%	0%
Diesel Fuel	0	0%	0%
Other Fuel	0	0%	0%
Natural Sources	0	0%	0%
Total	635	100%	10%
Total Statewide	**6244**		

Table 5-52

Diesel Particulate Matter

Emissions of diesel particulate matter are from mobile sources (approximately 89 percent) and stationary sources (approximately 12 percent).

San Joaquin Valley - Diesel PM			
Emissions Source	**tons/year**	**Percent Air Basin**	**Percent State**
Stationary Sources	481	12%	2%
Area-wide Sources	0	0%	0%
On-Road Mobile	935	23%	4%
Gasoline Vehicles	0	0%	0%
Diesel Vehicles	935	23%	4%
Other Mobile	2708	66%	11%
Gasoline Fuel	0	0%	0%
Diesel Fuel	2708	66%	11%
Other Fuel	0	0%	0%
Natural Sources	0	0%	0%
Total	4124	100%	17%
Total Statewide	**24497**		

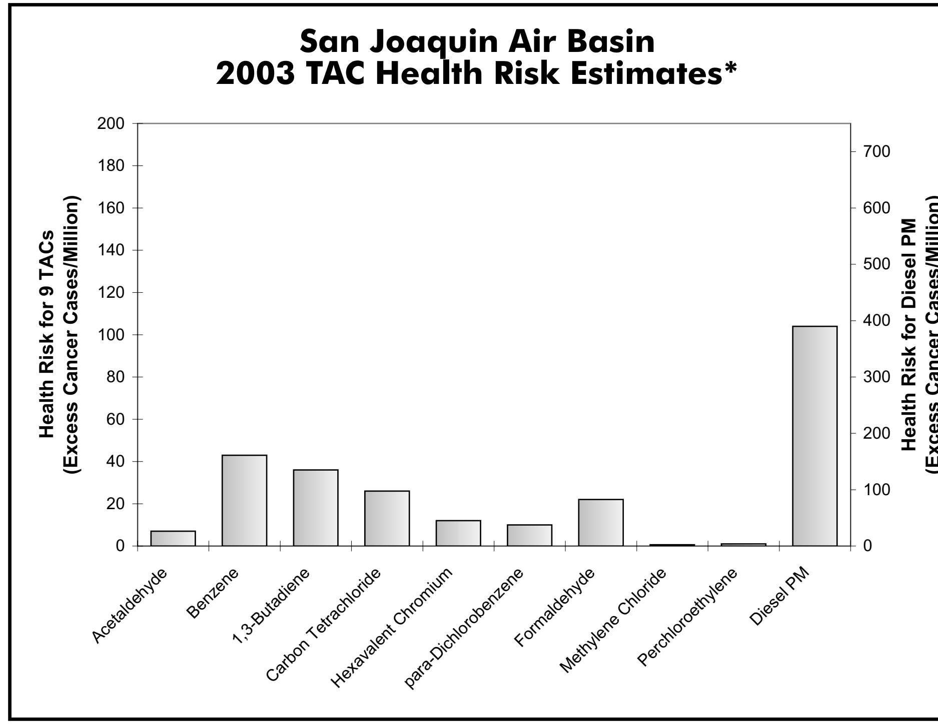
Table 5-53

San Joaquin Valley Air Basin
Air Quality and Health Risk

From 1990 through 2003, the ARB monitored ambient TAC concentrations at six sites in the San Joaquin Valley Air Basin. Data for all years are available only for the Stockton site. Data are available for 1991 through 2003 at the Fresno-First Street site, for 1990 through 1993 at the Bakersfield-Chester Avenue site, and for 1995 through 2003 at the Bakersfield-5558 California Avenue site. Data are also available at the Modesto-14th Street site from 1990 through 1999. In addition, limited TAC data are available at the Modesto-I Street site during 1991 to 1997. Annual average concentrations and associated health risks of the top ten TACs individually, as well as their cumulative health risk for the San Joaquin Valley Air Basin, are shown in Table 5-54. Data for individual sites are listed in Appendix C.

A special study site, located in the Fresno area of the San Joaquin Valley Air Basin, was operated between June 2002 and August 2003. Monitoring was conducted for both TACs and criteria air pollutants. This Fresno community is located in a residential neighborhood near sources of motor vehicle pollution. There is a large number of children living in the community. Although not included in the almanac, data from Fresno and other community monitoring studies are being used in support of the ARB's Community Health Program.

Figure 5-14 shows 2003 health risks posed by the top ten TACs individually for the San Joaquin Valley Air Basin. As indicated on the graph, the health risk data reflect the year of 2003 except for diesel PM. Data for this TAC reflect the year 2000, the most recent year for which complete and representative data are available. It is important to note that health risks shown here are based on an annual average concentration for all sites in the air basin. The health risk at individual locations may be higher or lower than the average for the air basin, depending on the impact of nearby sources.



* Data for diesel PM reflect 2000; data for all other TACs reflect 2003.

Figure 5-14

As in all other areas of the State, the health risk for diesel PM overwhelms the other nine TACs. Based on receptor modeling techniques, the diesel PM health risk in the San Joaquin Valley Air Basin for 2000 is estimated at 390 excess cancer cases per million people exposed over a 70-year lifetime. While this value is lower than the estimated statewide health risk, it is similar to values estimated for other urbanized areas of the State such as the San Diego Air Basin and the Sacramento Valley Air Basin. Since 1990, the estimated diesel PM concentration and associated health risk has decreased by 50 percent. Among the nine remaining TACs, 1,3-butadiene and benzene pose the greatest health risk. They have been reduced by 61 percent and 74 percent, respectively. Methylene chloride and perchloroethylene also show substantial reductions, and they have been reduced by 70 percent and 66 percent, respectively. Overall, in this air basin, all TACs except *para*-dichlorobenzene and formaldehyde have been reduced since 1990.

In general, the average concentrations and associated health risks of most TACs for the San Joaquin Valley Air Basin are lower than the statewide averages, and they are much lower than those for the South Coast Air Basin. It is important to note that there may be other compounds that pose a significant risk but are not monitored. Reductions in ambient levels of TACs should continue as additional control measures are implemented.

San Joaquin Valley Air Basin
Annual Average Concentrations and Health Risks

San Joaquin Valley Air Basin Toxic Air Contaminants-Annual Average Concentrations and Health Risks															
TAC*	**Conc./Risk**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**
Acetaldehyde	Annual Avg	1.94	1.84	1.38	1.73	1.29	0.54	1.28	1.19	1.30	1.56	1.09	1.15	1.24	1.34
	Health Risk	9	9	7	8	6	3	6	6	6	8	5	6	6	7
Benzene	Annual Avg	2.45	2.11	1.36	1.32	1.33	1.16	0.73	0.71	0.76	0.69	0.63	0.54	0.55	0.46
	Health Risk	227	196	126	122	123	107	68	66	71	64	58	50	51	43
1,3-Butadiene	Annual Avg	0.41	0.36	0.24	0.34	0.32	0.26	0.22	0.20	0.23	0.18	0.16	0.15	0.15	0.10
	Health Risk	154	135	89	127	121	99	83	73	88	67	59	56	55	36
Carbon Tetrachloride	Annual Avg	0.13	0.13		0.11		0.10	0.08		0.11		0.10	0.09	0.09	0.10
	Health Risk	34	34		29		26	20		30		25	23	24	26
Chromium, Hexavalent	Annual Avg			0.23	0.21	0.19	0.28	0.13	0.11	0.10	0.10	0.12		0.09	0.08
	Health Risk			34	31	29	42	20	16	15	15	18		13	12
para-Dichlorobenzene	Annual Avg		0.11	0.11	0.13	0.11	0.11	0.10	0.13			0.11	0.13	0.15	0.15
	Health Risk		7	7	9	7	8	7	9			7	9	10	10
Formaldehyde	Annual Avg	2.45	1.81	1.46	1.67	1.80	2.10	2.96	2.77	2.86	3.44	2.61	3.08	3.13	3.02
	Health Risk	18	13	11	12	13	15	22	20	21	25	19	23	23	22
Methylene Chloride	Annual Avg	0.76	0.59	0.55	0.76	0.59	0.61	0.54	0.53	0.52	0.50	0.53	0.27	0.16	0.14
	Health Risk	3	2	2	3	2	2	2	2	2	2	2	1	1	1
Perchloroethylene	Annual Avg	0.13	0.13	0.10	0.47	0.07	0.07	0.07	0.06	0.04		0.08	0.05	0.04	0.03
	Health Risk	5	5	4	19	3	3	3	2	2		3	2	2	1
*Diesel Particulate Matter***	*Annual Avg*	(2.6)					(1.7)					(1.3)			
	Health Risk	(780)					(510)					(390)			
Average Basin Risk***	Without Diesel PM	450	401	280	360	304	305	231	194	235	181	196	170	185	158
	With Diesel PM	*(1230)*					*(815)*					*(586)*			

* Concentrations for Hexavalent chromium are expressed as ng/m3 and concentrations for diesel PM are expressed as ug/m3. Concentrations for all other TACs are expressed as parts per billion.

** Diesel PM concentration estimates are based on receptor modeling techniques, and estimates are available only for selected years.

*** Health Risk represents the number of excess cancer cases per million people based on a lifetime (70-year) exposure to the annual average concentration. It reflects only those compounds listed in this table and only those with data for that year. There may be other significant compounds for which we do not monitor or have health risk information. Additional information about interpreting the toxic air contaminant air quality trends can be found in Chapter 1, *Interpreting the Emission and Air Quality Statistics.*

Table 5-54

San Diego Air Basin

2004 Emission Inventory by Compound

Acetaldehyde

Approximately 78 percent of the emissions of acetaldehyde are from mobile sources.

San Diego - Acetaldehyde			
Emissions Source	**tons/year**	**Percent Air Basin**	**Percent State**
Stationary Sources	6	1%	0%
Area-wide Sources	104	21%	1%
On-Road Mobile	136	27%	2%
Gasoline Vehicles	62	12%	1%
Diesel Vehicles	74	15%	1%
Other Mobile	262	51%	4%
Gasoline Fuel	60	12%	1%
Diesel Fuel	137	27%	2%
Other Fuel	65	13%	1%
Natural Sources	0	0%	0%
Total	508	100%	7%
Total Statewide	**7372**		

Table 5-55

Benzene

The primary sources of benzene emissions in the San Diego Air Basin are mobile sources (approximately 96 percent).

San Diego - Benzene			
Emissions Source	**tons/year**	**Percent Air Basin**	**Percent State**
Stationary Sources	37	4%	0%
Area-wide Sources	3	0%	0%
On-Road Mobile	519	58%	4%
Gasoline Vehicles	499	56%	4%
Diesel Vehicles	20	2%	0%
Other Mobile	339	38%	3%
Gasoline Fuel	274	31%	2%
Diesel Fuel	37	4%	0%
Other Fuel	27	3%	0%
Natural Sources	0	0%	0%
Total	899	100%	7%
Total Statewide	**13183**		

Table 5-56

1,3-Butadiene

Approximately 94 percent of the emissions of 1,3-butadiene are from mobile sources.

San Diego - 1,3-Butadiene			
Emissions Source	**tons/year**	**Percent Air Basin**	**Percent State**
Stationary Sources	< 1	0%	0%
Area-wide Sources	4	2%	0%
On-Road Mobile	108	50%	3%
Gasoline Vehicles	106	49%	3%
Diesel Vehicles	2	1%	0%
Other Mobile	94	44%	3%
Gasoline Fuel	66	31%	2%
Diesel Fuel	4	2%	0%
Other Fuel	25	11%	1%
Natural Sources	8	4%	0%
Total	215	100%	7%
Total Statewide	**3030**		

Table 5-57

Carbon Tetrachloride

Stationary sources such as chemical and allied product manufacturers account for all of the emissions of carbon tetrachloride.

San Diego - Carbon Tetrachloride			
Emissions Source	**tons/year**	**Percent Air Basin**	**Percent State**
Stationary Sources	0.12	100%	5%
Area-wide Sources	0	0%	0%
On-Road Mobile	0	0%	0%
Gasoline Vehicles	0	0%	0%
Diesel Vehicles	0	0%	0%
Other Mobile	0	0%	0%
Gasoline Fuel	0	0%	0%
Diesel Fuel	0	0%	0%
Other Fuel	0	0%	0%
Natural Sources	0	0%	0%
Total	0.12	100%	5%
Total Statewide	**2.30**		

Table 5-58

Chromium, Hexavalent

Approximately 76 percent of the hexavalent chromium emissions are from other mobile sources. Stationary sources account for approximately 18 percent.

San Diego - Chromium, Hexavalent			
Emissions Source	**tons/year**	**Percent Air Basin**	**Percent State**
Stationary Sources	0.04	18%	2%
Area-wide Sources	0	0%	0%
On-Road Mobile	0.01	6%	1%
Gasoline Vehicles	0.01	5%	1%
Diesel Vehicles	< .01	0%	0%
Other Mobile	0.18	76%	10%
Gasoline Fuel	0.01	5%	1%
Diesel Fuel	< .01	0%	0%
Other Fuel	0.17	71%	10%
Natural Sources	0	0%	0%
Total	0.24	100%	14%
Total Statewide	**1.73**		

Table 5-59

para-Dichlorobenzene

All of the emissions of *para*-dichlorobenzene are from consumer products (non-aerosol insect repellants and solid/gel air fresheners).

San Diego - *para*-DiChlorobenzene			
Emissions Source	**tons/year**	**Percent Air Basin**	**Percent State**
Stationary Sources	0	0%	0%
Area-wide Sources	161	100%	9%
On-Road Mobile	0	0%	0%
Gasoline Vehicles	0	0%	0%
Diesel Vehicles	0	0%	0%
Other Mobile	0	0%	0%
Gasoline Fuel	0	0%	0%
Diesel Fuel	0	0%	0%
Other Fuel	0	0%	0%
Natural Sources	0	0%	0%
Total	161	100%	9%
Total Statewide	**1879**		

Table 5-60

Formaldehyde

Approximately 88 percent of the formaldehyde emissions are from mobile sources.

San Diego - Formaldehyde			
Emissions Source	**tons/year**	**Percent Air Basin**	**Percent State**
Stationary Sources	39	3%	0%
Area-wide Sources	120	9%	1%
On-Road Mobile	434	33%	2%
Gasoline Vehicles	286	22%	1%
Diesel Vehicles	149	11%	1%
Other Mobile	731	55%	4%
Gasoline Fuel	246	19%	1%
Diesel Fuel	274	21%	1%
Other Fuel	211	16%	1%
Natural Sources	0	0%	0%
Total	1324	100%	7%
Total Statewide	**20251**		

Table 5-61

Methylene Chloride

Area-wide sources such as paint removers/strippers, automotive brake cleaners, and other consumer products account for approximately 83 percent of the emissions of methylene chloride.

San Diego - Methylene Chloride			
Emissions Source	**tons/year**	**Percent Air Basin**	**Percent State**
Stationary Sources	65	17%	1%
Area-wide Sources	313	83%	4%
On-Road Mobile	0	0%	0%
Gasoline Vehicles	0	0%	0%
Diesel Vehicles	0	0%	0%
Other Mobile	0	0%	0%
Gasoline Fuel	0	0%	0%
Diesel Fuel	0	0%	0%
Other Fuel	0	0%	0%
Natural Sources	0	0%	0%
Total	378	100%	5%
Total Statewide	**7637**		

Table 5-62

Perchloroethylene

Approximately 73 percent of the emissions of perchloroethylene are from stationary sources such as dry cleaning plants, manufacturers of aircraft parts and fabricated metal parts, and other stationary sources.

San Diego - Perchloroethylene			
Emissions Source	tons/year	Percent Air Basin	Percent State
Stationary Sources	462	73%	7%
Area-wide Sources	175	27%	3%
On-Road Mobile	0	0%	0%
Gasoline Vehicles	0	0%	0%
Diesel Vehicles	0	0%	0%
Other Mobile	0	0%	0%
Gasoline Fuel	0	0%	0%
Diesel Fuel	0	0%	0%
Other Fuel	0	0%	0%
Natural Sources	0	0%	0%
Total	638	100%	10%
Total Statewide	6244		

Table 5-63

Diesel Particulate Matter

Approximately 97 percent of the emissions of diesel particulate matter are from mobile sources.

San Diego - Diesel PM			
Emissions Source	tons/year	Percent Air Basin	Percent State
Stationary Sources	36	2%	0%
Area-wide Sources	0	0%	0%
On-Road Mobile	446	29%	2%
Gasoline Vehicles	0	0%	0%
Diesel Vehicles	446	29%	2%
Other Mobile	1045	68%	4%
Gasoline Fuel	0	0%	0%
Diesel Fuel	1045	68%	4%
Other Fuel	0	0%	0%
Natural Sources	0	0%	0%
Total	1527	100%	6%
Total Statewide	24497		

Table 5-64

San Diego Air Basin

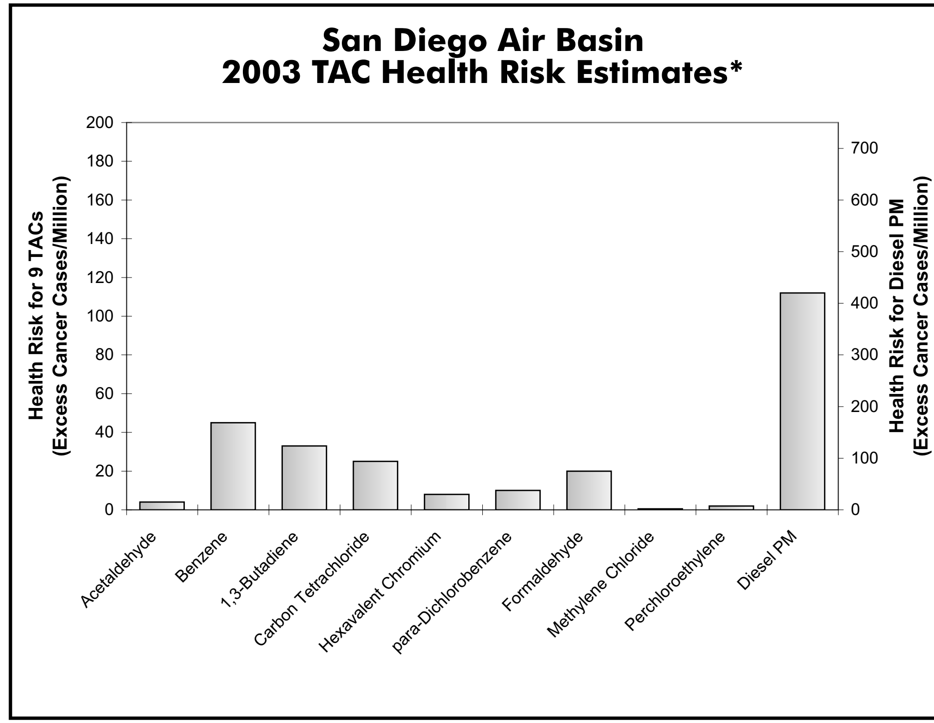
Air Quality and Health Risk

During 1990 through 2003, the ARB monitored ambient TAC concentrations at two sites in the San Diego Air Basin. The sites are located in Chula Vista and El Cajon. Annual average concentrations and health risks of the top ten TACs individually as well as their cumulative health risk for the San Diego Air Basin are listed in Table 5-65. Data for individual sites are shown in Appendix C.

A special study site, located in the Logan Heights/Barrio Logan area of San Diego, was operated between October 1999 and February 2001. Monitoring was conducted for both TACs and criteria air pollutants. The Barrio Logan community is located in a large urban area near major freeways, industrial sources, and neighborhood sources such as gas stations, dry cleaners, and automotive repair facilities. Although not included in this almanac, data from Barrio Logan and other community monitoring studies are being used in support of the ARB's Community Health Program. Copies of the full reports are available at *www.arb.ca.gov/ch/programs/sb25/sb25.htm*.

Figure 5-15 shows 2003 health risks posed by the top ten TACs individually for the San Diego Air Basin. As indicated on the graph, the health risk data reflect the year 2003 except for diesel PM. Data for this TAC reflect the year 2000, the most recent year for which complete and representative data are available. It is important to note that health risks shown here are based on an annual average concentration for all sites in the air basin. The health risk at individual locations may be higher or lower than the average for the air basin, depending on the impact of nearby sources.

Similar to most areas in the State, diesel PM presents the most substantial health risk among the ten TACs considered in this almanac. In the San Diego Air Basin, the estimated health risk for diesel PM in 2000 was 420 excess cancer cases per million people exposed over 70 years. While the health risk from diesel PM is lower than the estimated statewide value, it is comparable to the annual averages estimated for other urbanized areas such as the Sacramento Valley and San Joaquin Valley Air Basins. Since 1990, diesel PM health risk has been reduced by 52 percent in the San Diego Air Basin. Aside from diesel PM, 1,3-butadiene and benzene pose the greatest health risks among the nine remaining TACs. Since 1990, their risks have been



** Data for diesel PM reflect 2000; data for all other TACs reflect 2003.*

Figure 5-15

reduced by 59 percent and 73 percent, respectively. Perchloroethylene and methylene chloride also show significant reductions of 79 percent and 82 percent, respectively. Overall, in San Diego Air Basin, all TACs except *para*-dichlorobenzene and formaldehyde have been reduced since 1990.

It is important to note that there may be other compounds that pose a significant risk but are not monitored. Furthermore, reductions in ambient TAC concentrations and health risks should continue, as new rules and regulations are implemented to control toxic air contaminants.

San Diego Air Basin
Annual Average Concentrations and Health Risks

San Diego Air Basin Toxic Air Contaminants-Annual Average Concentrations and Health Risks															
TAC*	**Conc./Risk**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**
Acetaldehyde	Annual Avg	1.33	1.50	1.22	1.41	1.48	0.64	1.03	1.00	0.86	1.04	0.84	0.95	0.97	0.89
	Health Risk	6	7	6	7	7	3	5	5	4	5	4	5	5	4
Benzene	Annual Avg	2.25	1.70	1.48	1.16	1.39	0.98	0.76	0.76	0.76	0.86	0.65	0.51	0.49	0.48
	Health Risk	208	158	137	107	129	90	71	70	70	79	60	47	45	45
1,3-Butadiene	Annual Avg	0.33	0.26	0.26	0.31	0.31	0.24	0.21	0.20	0.20	0.22	0.16	0.14	0.12	0.09
	Health Risk	125	97	97	117	115	91	78	75	74	83	60	51	45	33
Carbon Tetrachloride	Annual Avg	0.13	0.13		0.10		0.10	0.08				0.09	0.09	0.09	0.09
	Health Risk	35	34		27		26	20				25	23	24	25
Chromium, Hexavalent	Annual Avg			0.24	0.19	0.16	0.18	0.11	0.11	0.10	0.10	0.10		0.05	0.05
	Health Risk			36	28	23	27	16	16	15	15	15		7	8
para-Dichlorobenzene	Annual Avg		0.10	0.11	0.13	0.15	0.12	0.11	0.13				0.15	0.15	0.15
	Health Risk		7	8	8	10	8	7	8				10	10	10
Formaldehyde	Annual Avg	1.64	1.53	1.26	1.76	2.25	2.13	2.62	2.62	2.27	2.67	2.23	2.59	2.99	2.68
	Health Risk	12	11	9	13	17	16	19	19	17	20	16	19	22	20
Methylene Chloride	Annual Avg	0.59	0.83	1.34	1.13	0.73	0.63	0.59	0.57		0.53	0.76	0.17	0.16	0.16
	Health Risk	2	3	5	4	3	2	2	2		2	3	1	1	1
Perchloroethylene	Annual Avg	0.28	0.27	0.26	0.20	0.21	0.25	0.15	0.13			0.09	0.06	0.06	0.05
	Health Risk	11	11	11	8	8	10	6	5			4	2	2	2
*Diesel Particulate Matter***	*Annual Avg*	*(2.9)*					*(1.9)*					*(1.4)*			
	Health Risk	*(870)*					*(570)*					*(420)*			
Average Basin Risk***	Without Diesel PM	399	328	309	319	312	273	224	200	180	204	187	158	161	148
	With Diesel PM	*(1269)*					*(843)*					*(607)*			

* Concentrations for Hexavalent chromium are expressed as ng/m3 and concentrations for diesel PM are expressed as ug/m3. Concentrations for all other TACs are expressed as parts per billion.

** Diesel PM concentration estimates are based on receptor modeling techniques, and estimates are available only for selected years.

*** Health Risk represents the number of excess cancer cases per million people based on a lifetime (70-year) exposure to the annual average concentration. It reflects only those compounds listed in this table and only those with data for that year. There may be other significant compounds for which we do not monitor or have health risk information. Additional information about interpreting the toxic air contaminant air quality trends can be found in Chapter 1, *Interpreting the Emission and Air Quality Statistics*.

Table 5-65

Sacramento Valley Air Basin

2004 Emission Inventory by Compound

Acetaldehyde

Approximately 60 percent of the emissions of acetaldehyde are from mobile sources. Another 36 percent are from area-wide sources, including the burning of wood in residential fireplaces and wood stoves.

Sacramento Valley - Acetaldehyde			
Emissions Source	**tons/year**	**Percent Air Basin**	**Percent State**
Stationary Sources	28	3%	0%
Area-wide Sources	290	36%	4%
On-Road Mobile	140	17%	2%
Gasoline Vehicles	59	7%	1%
Diesel Vehicles	81	10%	1%
Other Mobile	346	43%	5%
Gasoline Fuel	77	10%	1%
Diesel Fuel	228	28%	3%
Other Fuel	41	5%	1%
Natural Sources	0	0%	0%
Total	804	100%	11%
Total Statewide	**7372**		

Table 5-66

Benzene

The primary sources of benzene emissions in the Sacramento Valley Air Basin are mobile sources (approximately 86 percent).

Sacramento Valley - Benzene			
Emissions Source	**tons/year**	**Percent Air Basin**	**Percent State**
Stationary Sources	149	14%	1%
Area-wide Sources	8	1%	0%
On-Road Mobile	503	46%	4%
Gasoline Vehicles	481	44%	4%
Diesel Vehicles	22	2%	0%
Other Mobile	433	40%	3%
Gasoline Fuel	354	32%	3%
Diesel Fuel	62	6%	0%
Other Fuel	17	2%	0%
Natural Sources	0	0%	0%
Total	1093	100%	8%
Total Statewide	**13183**		

Table 5-67

1,3-Butadiene

Approximately 75 percent of the emissions of 1,3-butadiene are from mobile sources.

Sacramento Valley - 1,3-Butadiene			
Emissions Source	**tons/year**	**Percent Air Basin**	**Percent State**
Stationary Sources	< 1	0%	0%
Area-wide Sources	59	21%	2%
On-Road Mobile	103	37%	3%
Gasoline Vehicles	101	36%	3%
Diesel Vehicles	2	1%	0%
Other Mobile	107	38%	4%
Gasoline Fuel	85	31%	3%
Diesel Fuel	6	2%	0%
Other Fuel	15	6%	1%
Natural Sources	8	3%	0%
Total	278	100%	9%
Total Statewide	**3030**		

Table 5-68

Carbon Tetrachloride

Stationary sources such as chemical and allied product manufacturers account for all of the emissions of carbon tetrachloride.

Sacramento Valley - Carbon Tetrachloride			
Emissions Source	**tons/year**	**Percent Air Basin**	**Percent State**
Stationary Sources	0.05	100%	2%
Area-wide Sources	0	0%	0%
On-Road Mobile	0	0%	0%
Gasoline Vehicles	0	0%	0%
Diesel Vehicles	0	0%	0%
Other Mobile	0	0%	0%
Gasoline Fuel	0	0%	0%
Diesel Fuel	0	0%	0%
Other Fuel	0	0%	0%
Natural Sources	0	0%	0%
Total	0.05	100%	2%
Total Statewide	**2.30**		

Table 5-69

Chromium, Hexavalent

Approximately 55 percent of the hexavalent chromium emissions are from stationary sources such as electrical generation, aircraft and parts manufacturing, and fabricated metal product manufacturing.

Sacramento Valley - Chromium, Hexavalent			
Emissions Source	**tons/year**	**Percent Air Basin**	**Percent State**
Stationary Sources	0.05	55%	3%
Area-wide Sources	0	0%	0%
On-Road Mobile	< .01	10%	0%
Gasoline Vehicles	< .01	9%	0%
Diesel Vehicles	< .01	0%	0%
Other Mobile	0.03	36%	2%
Gasoline Fuel	0.02	18%	1%
Diesel Fuel	< .01	1%	0%
Other Fuel	0.01	17%	1%
Natural Sources	0	0%	0%
Total	0.08	100%	5%
Total Statewide	**1.73**		

Table 5-70

para-Dichlorobenzene

Most of the emissions of *para*-dichlorobenzene are from consumer products (non-aerosol insect repellants and solid/gel air fresheners).

Sacramento Valley - *para*-DiChlorobenzene			
Emissions Source	**tons/year**	**Percent Air Basin**	**Percent State**
Stationary Sources	< 1	0%	0%
Area-wide Sources	130	100%	7%
On-Road Mobile	0	0%	0%
Gasoline Vehicles	0	0%	0%
Diesel Vehicles	0	0%	0%
Other Mobile	0	0%	0%
Gasoline Fuel	0	0%	0%
Diesel Fuel	0	0%	0%
Other Fuel	0	0%	0%
Natural Sources	0	0%	0%
Total	130	100%	7%
Total Statewide	**1879**		

Table 5-71

Formaldehyde

Approximately 72 percent of the formaldehyde emissions are from mobile sources, and 18 percent are from area-wide sources.

Sacramento Valley - Formaldehyde			
Emissions Source	tons/year	Percent Air Basin	Percent State
Stationary Sources	193	10%	1%
Area-wide Sources	328	18%	2%
On-Road Mobile	425	23%	2%
Gasoline Vehicles	263	14%	1%
Diesel Vehicles	162	9%	1%
Other Mobile	909	49%	4%
Gasoline Fuel	320	17%	2%
Diesel Fuel	457	25%	2%
Other Fuel	132	7%	1%
Natural Sources	0	0%	0%
Total	1855	100%	9%
Total Statewide	20251		

Table 5-72

Methylene Chloride

Approximately 71 percent of the emissions of methylene chloride are from area-wide sources such as paint removers/strippers, automotive brake cleaners, and other consumer products.

Sacramento Valley - Methylene Chloride			
Emissions Source	tons/year	Percent Air Basin	Percent State
Stationary Sources	103	29%	1%
Area-wide Sources	253	71%	3%
On-Road Mobile	0	0%	0%
Gasoline Vehicles	0	0%	0%
Diesel Vehicles	0	0%	0%
Other Mobile	0	0%	0%
Gasoline Fuel	0	0%	0%
Diesel Fuel	0	0%	0%
Other Fuel	0	0%	0%
Natural Sources	0	0%	0%
Total	356	100%	5%
Total Statewide	7637		

Table 5-73

Perchloroethylene

Approximately 68 percent of the emissions of perchloroethylene are from stationary sources such as dry cleaning plants and manufacturers of aircraft parts and fabricated metal parts.

Sacramento Valley - Perchloroethylene			
Emissions Source	**tons/year**	**Percent Air Basin**	**Percent State**
Stationary Sources	296	68%	5%
Area-wide Sources	141	32%	2%
On-Road Mobile	0	0%	0%
Gasoline Vehicles	0	0%	0%
Diesel Vehicles	0	0%	0%
Other Mobile	0	0%	0%
Gasoline Fuel	0	0%	0%
Diesel Fuel	0	0%	0%
Other Fuel	0	0%	0%
Natural Sources	0	0%	0%
Total	438	100%	7%
Total Statewide	**6244**		

Table 5-74

Diesel Particulate Matter

Approximately 91 percent emissions of diesel particulate matter are from mobile sources.

Sacramento Valley - Diesel PM			
Emissions Source	**tons/year**	**Percent Air Basin**	**Percent State**
Stationary Sources	216	9%	1%
Area-wide Sources	0	0%	0%
On-Road Mobile	508	22%	2%
Gasoline Vehicles	0	0%	0%
Diesel Vehicles	508	22%	2%
Other Mobile	1629	69%	7%
Gasoline Fuel	0	0%	0%
Diesel Fuel	1629	69%	7%
Other Fuel	0	0%	0%
Natural Sources	0	0%	0%
Total	2353	100%	10%
Total Statewide	**24497**		

Table 5-75

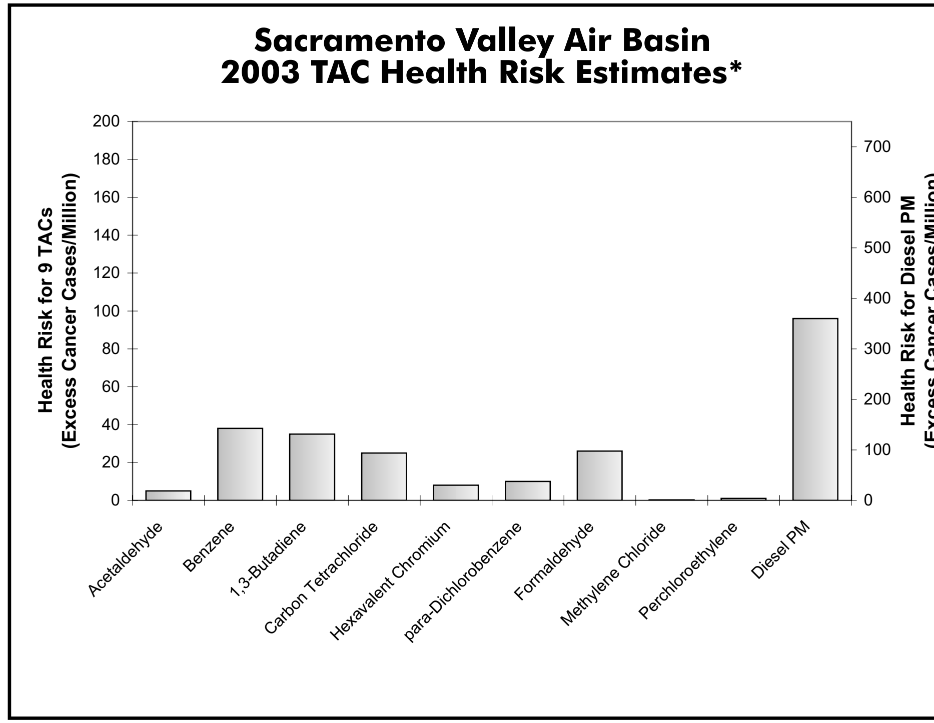
Sacramento Valley Air Basin

Air Quality and Health Risk

Unlike the other air basins described in this almanac, TAC monitoring in the Sacramento Valley Air Basin has not been continuous at any site. TAC concentrations were monitored at the Chico-Salem Street site during 1990 through the middle of 1992. The site was then moved to Chico-Manzanita Avenue. While there was monitoring in the Chico area during all of 1992, an annual average is not included here because neither site has a full year of data. Similarly, TAC concentrations were monitored at the Citrus Heights site during 1990 through part of 1993, when the site was relocated to Roseville. Again, no annual average concentration and associated health risk are available for the year during which the site was moved because neither site has a full year of data. Table 5-76 shows annual average concentrations and health risks of the top ten TACs individually, as well as their cumulative health risk for the Sacramento Valley Air Basin. Data for individual sites are listed in Appendix C.

Figure 5-16 is based on all data collected in the Sacramento Valley Air Basin and shows the estimated annual average health risks for the top ten TACs in this area. As shown in the graph, the health risk estimates for the nine TACs measured by the ambient network reflect 2003, the most recent year for which complete and representative data are available. The estimate for diesel PM reflects the year 2000. It is important to note that health risks shown here are based on two areas in the air basin, and other locations may be higher or lower than the average for the air basin, depending on the impact of nearby sources.

Diesel PM poses the greatest health risk among the ten TACs considered in this almanac. Based on receptor modeling techniques, the ARB estimated its health risk to be 360 excess cancer cases per million people in the Sacramento Valley Air Basin. This is about half the estimated statewide health risk, and it is similar to that for the San Joaquin Valley. Since 1990, the diesel PM's health risk has been reduced by 52 percent. Aside from diesel PM, 1,3-butadiene and benzene pose the greatest health risk in the Sacramento Valley Air Basin. They have been reduced by 66 percent and 76 percent, respectively. Methylene chloride and perchloroethylene also show substantial reduction of 74 percent and 66 percent, respectively. Overall, levels of most TACs have gone down since 1990 except *para*-dichloroben-



* Data for Diesel PM reflect 2000; data for all other TACs reflect 2003.

Figure 5-16

zene and formaldehyde. In 2003, formaldehyde shows a 19 percent increase from 1996, the first year a new method was used to analyze formaldehyde.

As in all areas of the State, it is important to note that there may be other compounds that are not monitored, but which may pose a substantial health risk in the Sacramento Valley Air Basin.

Sacramento Valley Air Basin
Annual Average Concentrations and Health Risks

Sacramento Valley Air Basin Toxic Air Contaminants-Annual Average Concentrations and Health Risks															
TAC*	**Conc./Risk**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**
Acetaldehyde	Annual Avg	1.29			1.37	1.04	0.39	1.03	1.05	0.92	1.23	0.83	0.74	1.14	1.04
	Health Risk	6			7	5	2	5	5	4	6	4	4	6	5
Benzene	Annual Avg	2.02	1.88	1.35	1.00	1.02	0.80	0.56	0.55	0.50	0.56	0.45	0.42	0.44	0.41
	Health Risk	187	174	125	92	95	74	51	51	47	52	42	39	41	38
1,3-Butadiene	Annual Avg	0.38	0.33	0.28	0.29	0.22	0.19	0.18	0.16	0.15	0.13	0.12	0.13	0.12	0.09
	Health Risk	142	125	106	108	83	70	66	60	58	48	45	47	44	35
Carbon Tetrachloride	Annual Avg	0.12	0.12		0.11		0.10	0.08				0.09	0.09	0.09	0.09
	Health Risk	33	32		29		26	21				25	23	24	25
Chromium, Hexavalent	Annual Avg			0.17	0.14	0.13	0.18	0.11	0.10	0.10	0.10	0.10	0.10	0.05	0.05
	Health Risk			26	21	19	26	16	15	15	15	15	15	8	8
para-Dichlorobenzene	Annual Avg			0.11	0.10	0.20	0.14	0.11	0.14			0.10	0.13	0.15	0.15
	Health Risk			7	7	14	9	7	10			7	9	10	10
Formaldehyde	Annual Avg	1.57			1.77	1.75	1.91	2.76	2.92	2.52	3.61	2.51	2.41	3.79	3.53
	Health Risk	12			13	13	14	20	22	19	27	18	18	28	26
Methylene Chloride	Annual Avg	0.65	0.56	0.55	0.98	0.66	0.53	0.54	0.52		0.60	0.57	0.29	0.08	0.08
	Health Risk	2	2	2	3	2	2	2	2		2	2	1	0	0
Perchloroethylene	Annual Avg	0.07	0.07	0.06	0.05	0.17	0.05	0.06	0.05			0.06	0.03	0.03	0.02
	Health Risk	3	3	3	2	7	2	2	2			2	1	1	1
*Diesel Particulate Matter***	*Annual Avg*	*(2.5)*					*(1.6)*					*(1.2)*			
	Health Risk	*(750)*					*(480)*					*(360)*			
Average Basin Risk***	Without Diesel PM	385	336	269	282	238	225	190	167	143	150	160	157	162	148
	With Diesel PM	*(1135)*					*(705)*					*(520)*			

* Concentrations for Hexavalent chromium are expressed as ng/m3 and concentrations for diesel PM are expressed as ug/m3. Concentrations for all other TACs are expressed as parts per billion.

** Diesel PM concentration estimates are based on receptor modeling techniques, and estimates are available only for selected years.

*** Health Risk represents the number of excess cancer cases per million people based on a lifetime (70-year) exposure to the annual average concentration. It reflects only those compounds listed in this table and only those with data for that year. There may be other significant compounds for which we do not monitor or have health risk information. Additional information about interpreting the toxic air contaminant air quality trends can be found in Chapter 1, *Interpreting the Emission and Air Quality Statistics*.

Table 5-76

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